

2007 ANNUAL REPORT FOR THE MONTANA DEPARTMENT OF TRANSPORTATION RESEARCH PROGRAMS

FHWA/MT-08-001/8010

Annual Report

prepared for
THE STATE OF MONTANA
DEPARTMENT OF TRANSPORTATION

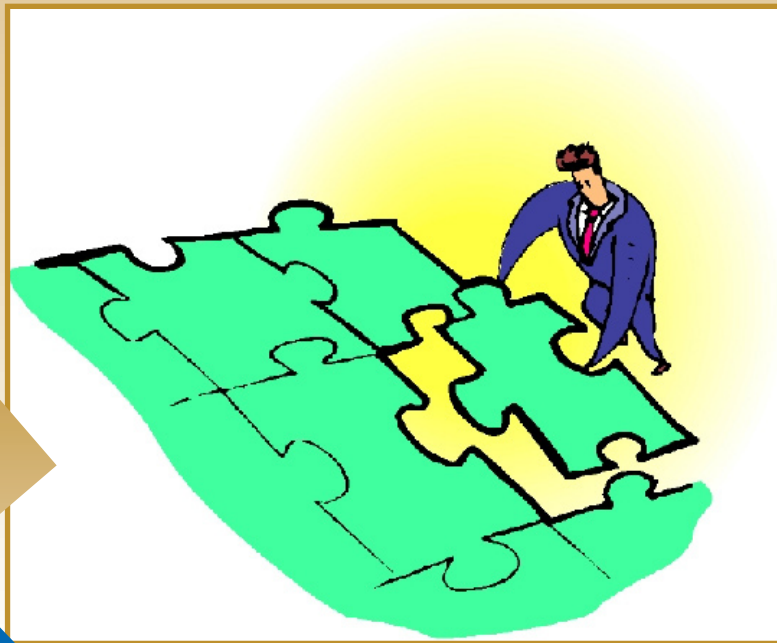
in cooperation with
THE U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

January 2008

prepared by

Susan C. Sillick
Craig Abernathy
Lisa Autio

Montana Department of Transportation



RESEARCH PROGRAMS



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**FFY 2007 ANNUAL REPORT
FOR THE MONTANA DEPARTMENT OF TRANSPORTATION
RESEARCH PROGRAMS**

**Prepared by
Susan C. Sillick
Craig Abernathy
Lisa Autio**

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16. Abstract <p>The Montana Department of Transportation (MDT) conducts research to discover, develop, or extend knowledge needed to operate, maintain, and improve the statewide multimodal transportation system. Specific goals include: evaluation and advancement of new technologies, materials, and methods; development of design and analysis techniques; and study of current transportation challenges. The purpose of this report is to give an overall description of research, development, and technology transfer activities for federal fiscal year (FFY) 2007 within the Research Programs of the Montana Department of Transportation (MDT). Through these activities, the Research Programs enhances MDT's ability to deliver efficient and effective transportation services. MDT's mission is to serve the public by providing a transportation system and services that emphasize quality, safety, cost effectiveness, economic vitality, and sensitivity to the environment. MDT's Research Programs impacts each and every part of MDT's mission. Research projects completed in FFY 2007 yielded results that when fully implemented will improve:</p> <ul style="list-style-type: none"> ➤ Efficiency and effectiveness of MDT operations and technology transfer, including improving training of and encouraging young individuals to enter the transportation construction work force; ➤ Economic vitality; ➤ Sensitivity to the environment, including decreasing vehicle-wildlife collisions, improving habitat connectivity, improving design for safety and fish passage, and improving revegetation of roadsides; ➤ Safety, by decreasing roadside hazards, decreasing young driver accidents, through training and technology transfer; and ➤ Quality of what we do and how we do it, including bridge design and inspection, pavement design and preservation, use of the most efficient materials and technology, and materials testing and acceptance. 					
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ALTERNATIVE FORMAT STATEMENT

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1 INTRODUCTION

The purpose of this report is to give an overall description of research, development, and technology transfer activities for federal fiscal year 2007 within the Research Programs of the Montana Department of Transportation (MDT). Through these activities the Research Programs enhances MDT's ability to deliver efficient and effective transportation services.

Responsibilities of the MDT Research Programs include:

- Administer the Research portion of the State Planning and Research Program (SPR);
- Lead and participate in cooperative research efforts with other states, universities, industry, and other partners through pooled-fund and other cooperative research, development, and technology transfer efforts;
- Assist MDT staff in identifying and finding ways to meet research needs;
- Provide leadership for research, development, technology, and technology transfer initiatives within MDT;
- Conduct the Research and Experimental Projects Programs, and the Technology Transfer Program;
- Assist with the implementation of research results; and
- Conduct project and program evaluation.

In taking a look back at where we have been, we are given a clearer view of where we are heading, continuously improving as we move forward.



Janus, this Roman God symbolizes change and transition, such as the progression from past to future or of one vision to another.

2 RESEARCH PROJECTS

2.1 OVERVIEW

Once a year, the Research Programs Manager solicits research ideas from as wide a variety of individuals as possible. This open solicitation enhances the possibility of receiving a diverse spectrum of research suggestions.

Before a problem statement can be prioritized, it must have a champion and a sponsor. A champion is internal to MDT, and is willing to support the problem statement to the Research Review Committee (RRC) and serve as the technical panel chairperson should the problem statement move forward to this stage. In doing this, the champion asserts there is a research need and this need is important to MDT. A sponsor is at least at the level of a Division or District Administrator who agrees the research is important to MDT and is willing to ensure implementation occurs. Only problem statements with both a champion and sponsor move forward to the project prioritization stage.

The champions for each problem statement present their topic to the RRC and District Administrators (DA) for individual rating. Each member of these two groups rates every problem with respect to their overall worth (50%), timeliness (30%), and attainability (20%).

The RRC then reviews the ratings and comments, and selects the high priority topics for that solicitation cycle. These topics are chosen because they address actual concerns of the Department.

Following the selection of these high priority topics, Research Programs staff forms a technical panel for each topic. Technical panels are formed to follow research projects from inception through implementation. Technical panels are typically composed of three to ten people with knowledge or expertise, and interest in the specific area of research. Panel members are drawn from MDT's Division and District offices, as well as from outside the Department. The technical panel's responsibility begins with a review of the literature to determine the need for research, if any, and continues with the development of a viable research plan. This plan should include: what tasks need to be accomplished; how much time and money needs to be expended; who should perform the research; what are the barriers to implementation and how to reduce or eliminate these barriers; and what research products should be delivered to facilitate implementation. Final funding is approved by the RRC.

During and following the research, the Research Programs representative on each technical panel serves as MDT's project manager and liaison between the technical

panel and the consultant. The technical panel monitors research progress by reviewing quarterly, final, and any other reports produced by the principal investigator. Finally, the technical panel makes implementation recommendations to the appropriate MDT Administrator, through the RRC.

The research projects process as detailed above is shown in Figure 1. In addition to the solicitation process (as described above), there are a number of other methods to initiate research projects: Montana Partnership for the Advancement of Research in Transportation (MPART Small Projects), Wildlife and Fisheries Memorandum of Agreement (MOA), MDT/Western Transportation Institute (WTI) Partnership, and Administration High Priority topics (Figure 1).

MDT has contracts in place with both Montana State University and The University of Montana for small projects (<\$25,000 and 1 year) under our MPART Small Projects agreement. If there is a need for a small project, such as a synthesis project, which includes a review of the literature and a survey of the state of the practice, similar to National Cooperative Highway Research Program (NCHRP) synthesis projects, the steps below are followed:

- Champion notifies Research Programs of need.
- Technical panel is formed.
- Proposal is obtained.
- Technical panel recommends proposal for funding to RRC.
- RRC approves or denies funding request.

Also, MDT meets periodically with the Western Transportation Institute (WTI) to discuss collaborative research in 9 topic areas: education, infrastructure design and materials, logistics and freight management, mobility and public transportation, road ecology, safety and operations, systems engineering development and integration, transportation planning and economics, and weather and winter maintenance. Research is funded 50% each by MDT and WTI. Once research ideas are identified and there is interest to move forward with the project, the following steps are followed:

- Technical panel is formed.
- Proposal is obtained.
- Technical panel recommends proposal for funding to RRC.
- RRC approves or denies funding request.

In addition, MDT has a MOA with both universities for the conduct of wildlife and fisheries research. A standing technical panel exists for these projects. As funding is available, the technical panel meets to determine needs and issues a request for proposal (RFP) to both universities. The panel reviews proposals and recommends funding for the top proposals in each funding area. The RRC either approves or denies funding.

Finally, if MDT Administration identifies a research need that requires immediate attention, the Research Programs manager is informed, a technical panel is formed, and a proposal(s) is obtained and approved either by the RRC or Administration.

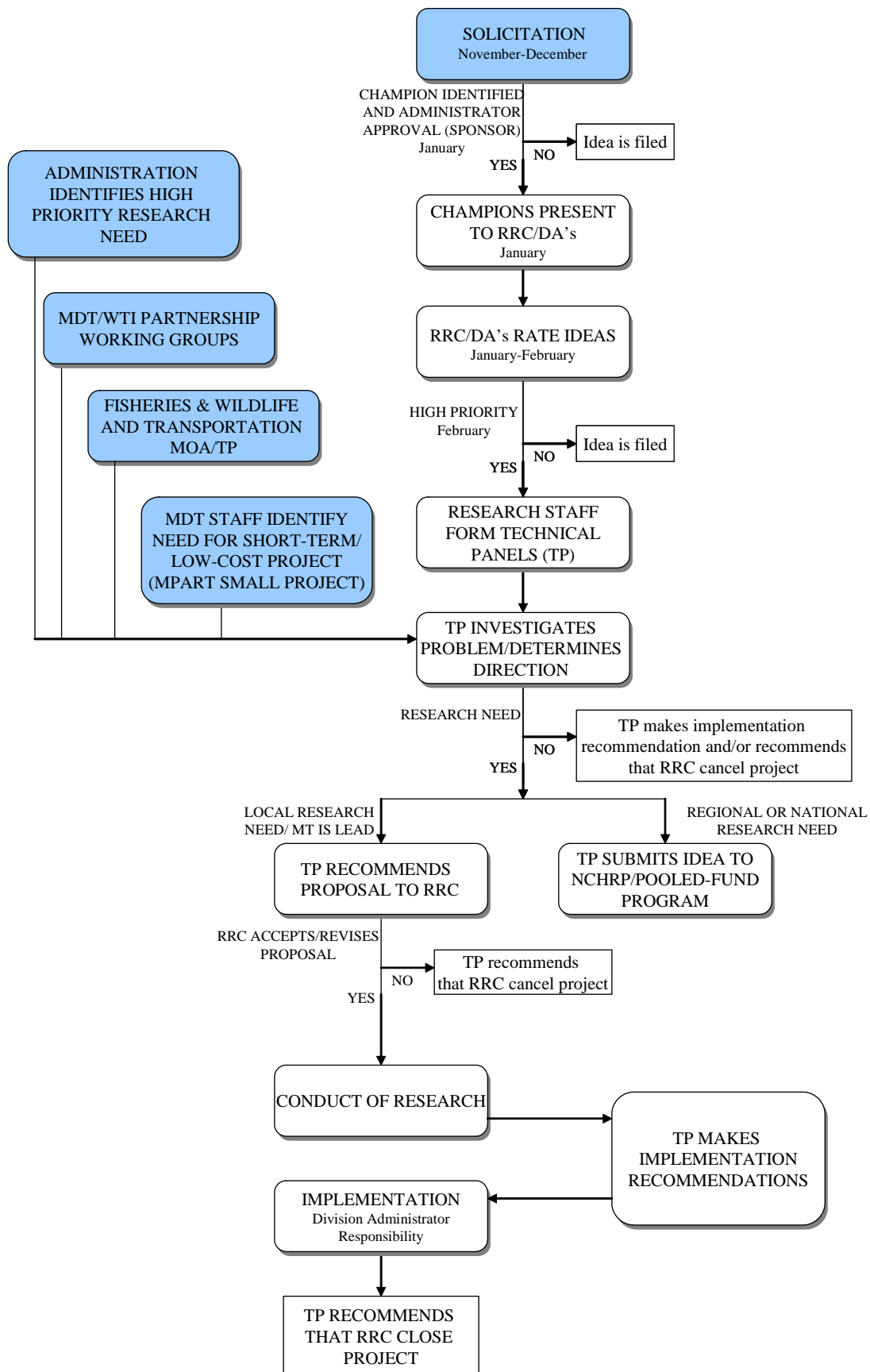


Figure 1: Research projects process.

2.2 ADMINISTRATIVE RESEARCH PROJECTS

2.2.1 Continuing Projects

2.2.1.1 Administration and Conduct of Research Programs

Project Number:	8010	Project Number:	8020
Start Date:	10/1/06	Start Date:	10/1/06
Completion Date:	9/30/07	Completion Date:	9/30/07
Total Cost:	\$222,615	Total Cost:	\$31,823
SPR Funds:	\$222,615	SPR Funds:	\$31,823
FFY 2007 Funds Expended:	\$222,615	FFY 2007 Funds Expended:	\$31,823
FFY 2007 MDT Indirect Costs:	\$6,596	FFY 2007 MDT Indirect Costs:	\$1,442
Status:	Continuing	Status:	Continuing

Objective:

The purpose of these two ongoing projects is threefold. The first purpose is to plan and administer the Research Programs and related research activities of MDT in finding solutions to existing highway and transportation challenges in Montana. The second purpose is to manage, coordinate, and conduct a program to test and properly evaluate new highway materials, products, designs, methods, etc., for the ultimate purpose of improving highway performance; decreasing various highway costs; or attempting to solve existing highway construction, rehabilitation, or maintenance problems in Montana. The third purpose is to plan and conduct a program of technology transfer and to develop and maintain a knowledge and understanding of the latest highway research projects and programs.

Progress-Research Projects:

During FFY 2007, for the Research Projects Program, one solicitation cycle was completed, resulting in four new research projects:

- Growing Smart in Transportation and Development: Tools for State and Local Decision Makers;
- Preventing Adverse Effects from Highway Noise: A Toolkit for Local Planners;
- Soil Stabilization using Byproducts; and
- Varmint Impact on Shoulders and Paved Surfaces.

Three MPART projects were initiated in FFY 2007:

- Preventing Adverse Effects from Highway Noise: A Toolkit for Local Planners;

- US 93 South Statistical Evaluation; and
- Wildlife-Vehicle Collision and Crossing Mitigation Measures: A Toolbox for the Montana Department of Transportation.

Sixteen projects are contracted and remain active:

- Automated Cost Recovery;
- Axial Capacity of Piles Supported on Intermediate Geomaterials;
- Bozeman Pass Wildlife Linkage and Channelization and Highway Safety Studies;
- Business Market Analysis;
- Developing a One-Stop Shop for Public/Specialized Transportation Information in Montana;
- Disparity/ Availability Study;
- Effects of Defensive Vehicle Handling Training on Novice Driver Safety: Phase 3 Analysis of Safety Data;
- Evaluation Methods of Estimation of Bridge-Pier Scour for Streams with Coarse Bed Materials Based on Observed Scour in Montana;
- Evaluation of MDT's Research Project Solicitation, Prioritization, and Selection Processes;
- Evaluation of Wildlife Crossing Structures on US Highway 93 Evaro to Polson;
- Highway Project Cost Estimating Best Practices;
- I-15 North Corridor – Canadian Truck Load Bridge and Roadway Analysis;
- Industry Best Practices for Applications Development Processes;
- Logistics and Marketing Research in Support of Container on Flatcar Shuttle Train on the Burlington Northern Santa Fe Mainline to Port of Seattle or Tacoma;
- Montana Summer Transportation Institute; and
- Preventing Adverse Effects from Highway Noise: A Toolkit for Local Planners.

In addition, nine projects are pending technical panel and Research Review Committee (RRC) review and approval:

- Compost Application for Optimized Vegetation Response;
- Computerized 3-Dimensional Highway Design and Modeling;
- Design of a Vertical Shape Portable Concrete Barrier;
- Determination of Unbound Base and Subgrade Resilient Moduli for Use in the Mechanistic-Empirical Pavement Design Guide;
- Development of Wildlife Crossing Structures for Small and Large Species and Analysis of their Effectiveness;
- Growing Smart in Transportation and Development: Tools for State and Local Decision Makers;
- Implementation of the Mechanistic-Empirical Pavement Design Guide for Designing Flexible Pavements in Montana;
- Soil Stabilization using Byproducts; and
- Varmint Impact on Shoulders and Paved Surfaces.

Sixteen active research projects were completed:

- Comparative Analysis of Coarse Surfacing Aggregate using the Micro-Deval, L.A. Abrasion, and Sulfate Soundness Tests;
- Evaluation of Organic Matter Compost Addition and Incorporation in Steep Cut Slopes: Phase II Test Plot Construction and Performance Monitoring;
- Experimental Assessment of Aggregate Surfacing Materials;
- Fish Passage at Road Crossings in a Montana Watershed: Phase II Passage Goals;
- Habitat Connectivity and Rural Context Sensitive Design: A Synthesis of Practice;
- A High Fidelity Driving Simulator as a Tool for Design and Evaluation of Highway Infrastructure Upgrades;
- Implementation of High Performance Concrete;
- Mechanistic-Empirical Pavement Design Guide Flexible Pavement Performance Prediction Models for Montana;
- Montana Air Service: Opportunities and Challenges;
- Motor Fuel Tax Evasion in the State of Montana;
- On-the Job Program Evaluation;
- Potential Effects of Highway Mortality and Habitat Fragmentation on a Population of Painted Turtles in Montana;
- Preventive Maintenance Treatments: a Synthesis of Highway Practice;
- US 93 South Statistical Evaluation;
- Warm Water Species Fish Passage in Eastern Montana Culverts; and
- Wildlife-Vehicle Collision and Crossing Mitigation Measures: A Toolbox for the Montana Department of Transportation.

A research project close-out questionnaire was sent to all technical panel members at the completion of each research project. Results were compiled and disseminated with the ultimate goal of improving conduct and management of research projects.

Finally, one project was cancelled:

- Evaluation of the Superpave Volumetric Specification.

Progress - Experimental Projects:

During FFY 2007, four experimental projects were completed

- Detectable Warning Devices for the Visually Impaired Evaluation;
- Pavement Markers on MacDonald Pass Evaluation;
- Radar Speed Display Trailer-Mounted Device for Speed Reduction in Construction Work Zones Evaluation; and
- Treated Base Preparations, (Emulsified Asphalt Treated Aggregate) Evaluation.

Thirteen experimental projects are active.

- 100 mm Thin Composite Whitetopping;
- 130 mm Thin Composite Whitetopping;
- Automated Fixed Anti-Icing Device for Use on Bridge Decks Evaluation;
- Cold In-Place Recycled Asphalt;
- Cold In-Place Recycled Asphalt using Koch's CIR-Engineered Emulsion;
- Crack Sealing Milled Asphalt Pavement prior to Overlay Evaluation;
- Detectable Warning Devices Evaluation;
- Edge-Line Pavement Markings on Rumble Stripes Evaluation;
- GeoRidge Erosion Control Permeable Ditch Berm Evaluation;
- High-Density Polyethylene Culverts in Mainline Application Evaluation;
- High-Performance Concrete Bridge Deck Evaluation;
- Recycled Plastic Mat as Weed Prevention and Erosion Control around Guardrail Posts Evaluation; and
- Tower-Mounted Wind Turbine for the Generation of Supplemental Power for the Anaconda Interchange Rest Area Evaluation.

Six experimental projects are pending construction:

- Chip Seal as an Interlayer in an Asphalt Cement Pavement to Retard Reflective Cracking Evaluation;
- Deer Reflectors Evaluation;
- Fabrics to Mitigate Transverse Cracking Evaluation;
- Highways for Life Program: Rehabilitation of Ten Failed Culverts with Two New Construction Methods to Minimize Traffic Delay;
- Pavement Performance with Prior Emulsified Asphalt Treated Aggregate Base Treatment Evaluation; and
- Plant Mix Surface with In-Laid Thermoplastic Markings prior to Seal Coat Application Evaluation.

One experimental project was cancelled due to lack of funding:

- Aggregate Base Preparations Evaluation.

Progress - Library Services:

Library activities for FFY 2007 presented here include various performance measures and a web site analysis report.

Library services to employees, other Montana state agencies, and others include:

- Circulation;
- Book suggestions and brief assistance;
- New patrons registered and deleted;
- In depth reference questions;
- E-mail responses;

- Literature searches;
- Photocopying;
- Locating websites;
- Original and copy cataloging of new reports (books, e-books, and other formats);
- Retrieving articles from websites and databases;
- Sending library items to outlying sites;
- Presenting library awareness at conferences;
- Interlibrary loans, borrowing and lending;
- Marketing of library topics, database, and catalog in MDT interchange;
- Donating reports to state Department's of Transportation libraries and others;
- Copying reports from other agencies for employees;
- Supporting management classes through book recommendations and presentations;
- Attending education workshops to improve library operations;
- Maintaining shelf collection for improved retrieval;
- Lobbying efforts for databases useful to MDT employees from the Montana State Library (MSL);
- Networking with other library groups to improve operations, access, and operations, as found in transportation librarian toolkit;
- Tracking of overdue items to maintain catalog integrity;
- Addition of transportation research thesaurus subject headings;
- Requesting reports from other libraries' giveaway lists;
- Contributions to library networks through participation, such as taking minutes of meetings;
- Library training;
- Developing procedures manual;
- Creating four quarterly newsletters; and
- Sending reports to print shop for patrons and library collection.

Information requests were tracked monthly beginning January 1, 2007 (Table 1).

Table 1: Monthly information requests.

MONTH	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
# of REQUESTS	186	205	273	161	283	163	158	278	192	1626

Web Site Analysis Report:

- Over 1.3 million visits to the research web pages.
- 4,368 visits from library catalog browsers. This indicates many patrons who use the library are going directly to the online catalog.
- Most visitors to the library website are MDT employees, approximately 275,000. The next largest referrals come from Google (58,881), Google China (21,854), and Google Scholar (6,908). Other visitors, in decreasing order, include: chaiqing.net

(Chinese search engine), Canada, India, UK, Italy, Yahoo, Egypt, Korea, Germany, TRB, Australia, France, Vietnam, Indonesia, Turkey, Thailand, Spain, and Malaysia.

- 9,719 files were downloaded from the Research web pages. The portable document file (PDF) is the most common file type accessed.
- Nearly 65,000 unique visitors to the Research web pages, more than seven visitors per hour and 15,000 repeat visitors.
- Average number of pages viewed per day was 614, and the average visitor stayed 12 minutes.

Library Analysis Report:

- There were 1,172 titles in all formats (1,363 total copies) added to the collection (<http://www.mdt.mt.gov/research/unique/services.shtml>) in FFY 2007 (This does not include the 2,032 NetLibrary e-book titles imported as a part of a contract negotiated with the Montana State Library): 1 audio recording, 851 books, 2 briefs, 73 CD's, 49 DVD's, 74 e-books, 3 kits, 2 pamphlets, 2 summaries, and 116 videocassette recordings (Figure 2).

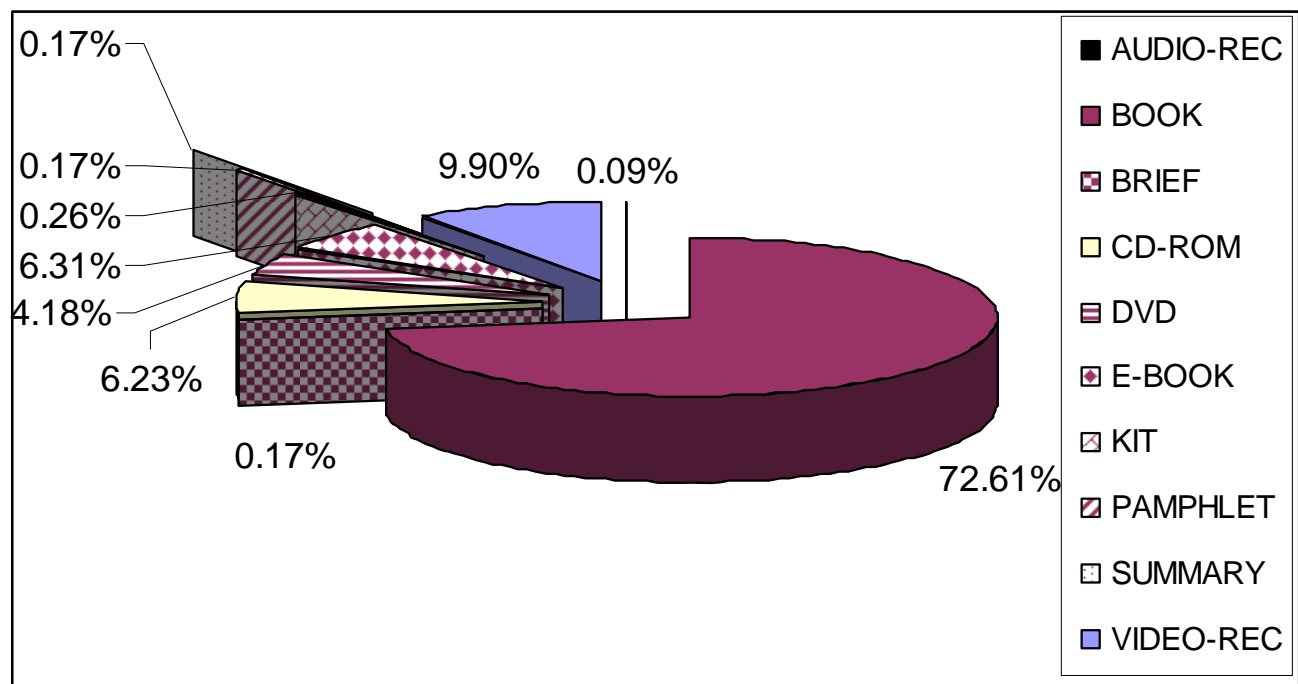


Figure 2: Total number of titles by item type added to the catalog in FFY 2007.

- There were 23,035 total titles in collection at the completion of FFY 2007. By item type the collection contained: 28 audio recordings, 12,751 books, 162 CD-ROM's, 66 DVD's, 9,137 e-books, 9 internet resources, 59 kits, and 823 videocassette recordings (Figure 3).

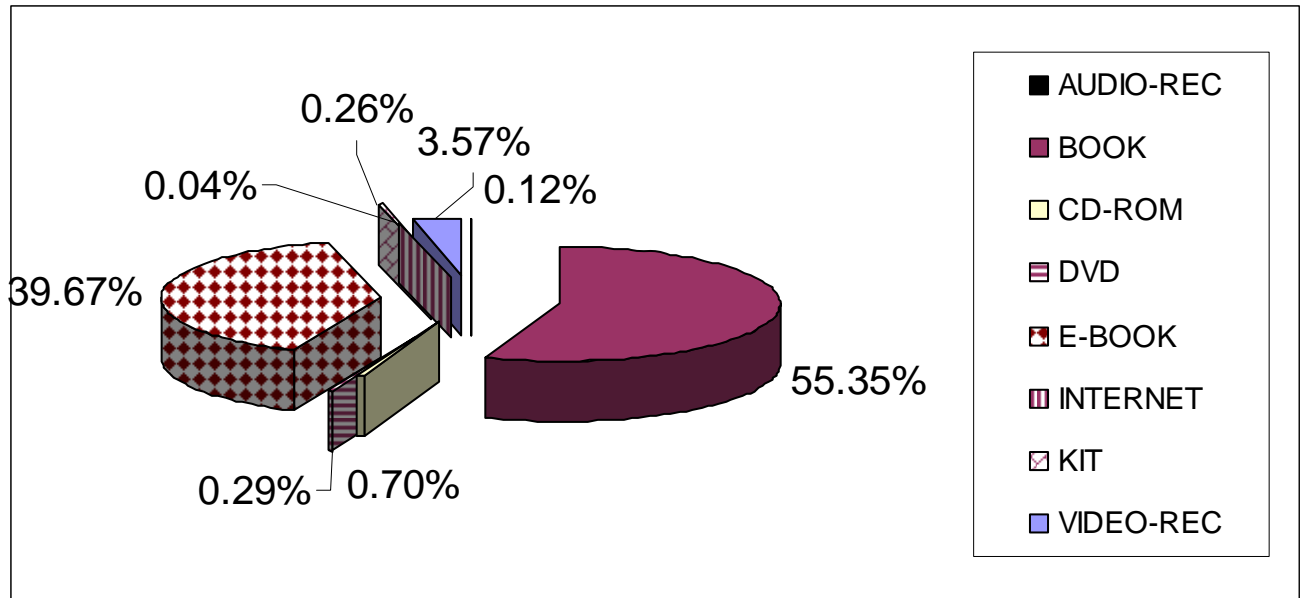


Figure 3: Total number of titles by item type in the catalog.

- In FFY 2007, total circulation was 792, by item type: 19 audio recordings, 463 books, 50 CD's, 20 DVD's, 18 kits, 12 microforms, and 200 videocassette recordings (Figure 4).

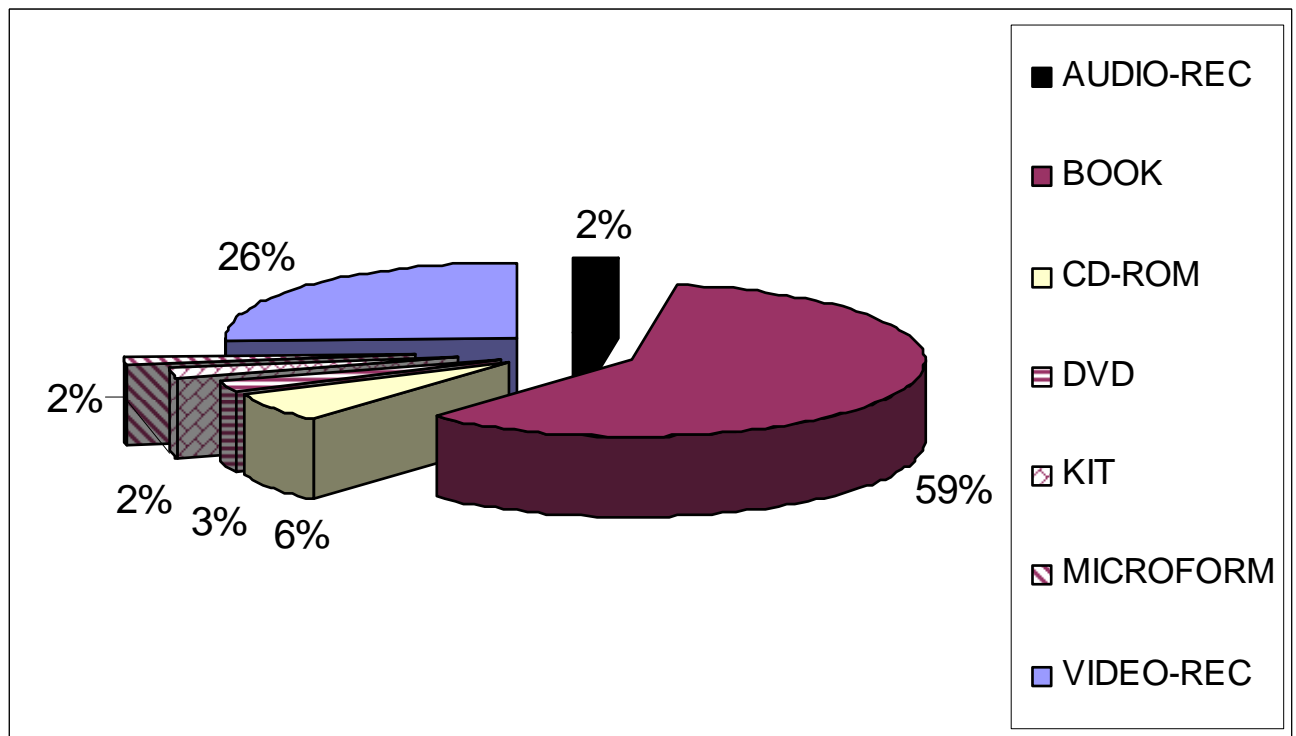


Figure 4: Total circulation by item type in FFY 2007.

Reports/Training/Technology Transfer:

- Research and experimental project progress and final reports were published on the Research Programs website (<http://www.mdt.mt.gov/research/>) and/or in hard copy.
- Four newsletters were published (http://www.mdt.mt.gov/research/tech_trans/newsletters.shtml).
- The FFY 2006 Annual report was published in early FFY 2007 (http://www.mdt.mt.gov/research/annual_report.shtml).
- One Research Programs Overview presentation was given to MDT staff.
- The Research Review Committee (RRC) met seven times throughout the year to discuss research and pooled-fund projects.
- Two MDT/WTI partnership working groups met in FFY 2007.
- The Research Programs Manager attended the Transportation Research Board Annual Meeting (TRB), TRB State Representatives meeting, TRB Conduct of Research Committee mid-year meeting, Alaska University Transportation Center Project Selection Committee Meeting, American Association of State Highway and Transportation Officials (AASHTO) National Research Advisory Committee Meeting, and the Local Technical Assistance Program (LTAP) and WTI Research Advisory Committee meetings. The Librarian attended the Transportation Library Connectivity Pooled Fund meeting, OFFLINE, Montana Shared Catalog meetings, Montana Digital Summit, and a cataloging workshop. She also presented Library awareness at the MDT Engineering Conference, MDT management classes, and the Montana Library Association Academic and Special Libraries Division.
- Finally, performance appraisals were conducted for all Research Programs staff and performance plans were developed for the upcoming year.

MDT Project Manager:

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2.2.1.2 Evaluation of Experimental Projects

Project Number:	8021
Start Date:	10/1/06
Completion Date:	9/30/07
Total Cost:	\$2,083
SPR Funds:	\$2,083
FFY 2007 Funds Expended:	\$2,083
FFY 2007 MDT Indirect Costs:	\$36
Status:	Continuing

Objective:

The purpose of this ongoing project is to provide a limited funding source for fieldwork involved in the inspection and evaluation of experimental projects and the conduct of research, where other funds are not appropriate or available.

Progress:

Field support for the evaluation of experimental projects was provided.

MDT Project Manager:

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2.2.1.3 Transportation Research Board Support

MDT provides ongoing financial support to the Transportation Research Board (TRB) in two ways. Support of core services is provided through a pooled-fund study (see Section 4.0, <http://trb.org/>, and <http://www.pooledfund.org/projectdetails.asp?id=360&status=6>). The amount of funding is based on a triennium. For each year in the current triennium, MDT paid \$99,900 to support TRB core services. The National Cooperative Highway Research Program (NCHRP) is also supported through research funds (see <http://www.trb.org/CRP/NCHRP/NCHRP.asp>). The annual support amount is 5.5% of the total State Planning and Research (SPR) funds. For FFY 2007, support was provided in the amount of \$354,701.

MDT Project Manager:

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2.2.1.4 Montana Local Technical Assistance Program (LTAP)

Project Number:	2443
Start Date:	7/1/06
Completion Date:	6/30/07
Total Cost:	\$340,000
SPR Funds:	\$68,000
Federal Funds:	\$170,000
State Funds:	\$100,000
Contractor Cost Share:	\$2,000
FFY 2006* Funds Expended:	\$340,000
Status:	Continuing
Contractor:	Montana State University
URL:	http://www.mdt.mt.gov/research/ltap/ltap.shtml

* Note: The LTAP program is run on a state fiscal year. Hence, it is run nine months behind the federal fiscal year. FFY 2007 LTAP is currently active running from 7/1/07 to 6/30/08. Therefore, the FFY 2006 LTAP Program is presented here.

Objective:

The mission of the national Local Technical Assistance Program (LTAP) is to foster a safe, efficient, and environmentally sound transportation system by improving skills and knowledge of local transportation providers through training, technical assistance, and technology transfer.

LTAP centers enable local counties, parishes, townships, cities, and towns to improve their roads and bridges by supplying them with a variety of training programs, information clearinghouse, new and existing technology updates, personalized technical assistance, and newsletters.

Through these core services, LTAP centers provide access to training and information that may not have otherwise been accessible. Centers are able to provide local road departments with work force development services, resources to enhance safety and security, solutions to environmental, congestion, capacity and other issues, technical publications, and training videos and materials.

Montana has over 70,000 miles of roads in cities, counties, and highway districts. Montana LTAP has focused on assisting state and county road offices and city street departments in road and bridge maintenance and repair. By sharing technical information and improving the distribution of this information, the program promotes efficient use of local transportation agencies' scarce resources.

Specific LTAP tasks in FFY 2006 included: compile and maintain a mailing list, publish a quarterly newsletter, provide technology transfer materials, provide information and on-site technical assistance, conduct or arrange seminars/training sessions, and program evaluation.

Progress:

LTAP's mailing list has been revised and updated with current information. There were four quarterly newsletters published. Technical assists and information were distributed and responded to through phone calls, faxes, personal contact at workshops, conferences, and e-mail. Fifty-four workshops presented during this time period included Work Zone Traffic Control, Train the Trainer, Forklift Certification, PASER, Surveying Techniques, Gravel Roads Maintenance, Community and Personal Preparedness, Stormwater Management & Drainage, Winter Survival, Finger Safety, Slips-Trips-and-Falls, Safety Design (includes AASHTO information), Traffic Control Supervisor, County Road Standards, Loader Equipment Safety, Safety Engineering, Leadership, Summer Survival, and Signing and Liability.

Reports:

Three quarterly progress reports were submitted and can be viewed at the above URL. One quarterly progress report was not submitted during this time frame due to staffing changes.

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Contractor Project Manager:

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2.2.1.5 Montana Summer Transportation Institute

Project Number:	6439
Start Date:	10/1/06
Completion Date:	4/31/08
Total Cost:	\$47,368
SPR Funds:	\$0
Federal funds:	\$40,168
Cost Share:	\$7,200
FFY 2007 Funds Expended:	\$23,767
Unexpended Funds:	\$16,401
FFY 2007 MDT Indirect Costs:	\$734
Status:	Continuing
Contractor:	Western Transportation Institute, Montana State University

URL: <http://www.mdt.mt.gov/research/projects/admin/summer.shtml>

Objective:

The objectives of this annual program are to: increase students' awareness of the importance of different modes of transportation; expose high school students to the variety of transportation careers available and demonstrate how transportation professionals work to identify and solve real-world issues that have society-wide impacts; increase students' understanding of the importance and need for creative and innovative transportation solutions; improve students' analytical and problem-solving skills; develop students' communication, collaboration, and leadership skills; and bolster student confidence by improving academic skills and providing college and career guidance.

Progress:

All research has been completed. The final report is in review and will be finished early FFY 2008.

Reports:

Four progress reports were submitted. The final report was completed in early FFY 2008 prior to the publication of this report and can be viewed at the above URL.

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2.2.2 Completed Projects

2.2.2.1 OJT Program Evaluation

Project Number:	8117-28
Start Date:	9/13/05
Completion Date:	6/30/07
Total Cost:	\$21,978
SPR Funds:	\$18,315
Contractor Cost Share:	\$3,663
FFY 2007 Funds Expended:	\$2,408
Unexpended Funds:	\$0
Status:	Completed
Contractor:	The University of Montana
URL:	http://www.mdt.mt.gov/research/projects/admin/ojt.shtml

Objective:

The purpose of this project was to provide information regarding the experiences of trainees, contractors, MDT field staff, and other state staff in the On-the-Job (OJT) Program.

Progress:

All research is complete.

Reports:

The final report was published, distributed, and can be viewed at the above URL.

Implementation:

Overall the program was rated very good. Most all individuals interviewed rated the training as good or excellent, with only approximately 6% rating the program as poor. Based on the results of the research project, there were some recommendations to improve the program.

The question was raised as to whether 500 hours of on-the-job training was sufficient to have the skills necessary toward attaining journeyman status. One of the issues is the number of trainees that a project can actually support. The tendency is to put as many trainees on a project as possible and at times the effectiveness of the training is at risk. MDT's Civil Rights Bureau (CRB) will encourage District personnel, Tribal Employment

Rights Office (TERO), etc., to realistically estimate how many trainees can be supported on each project to make the program more effective.

Time spent with the trainee was also cited as a barrier. Interaction with supervisors, MDT staff, and other OJT staff is an issue for the majority of those interviewed. Based on this information, MDT CRB will set a goal to meet with each individual trainee one time during their trainee program. This will allow trainees to provide feedback and will help trainees to feel they are being provided the guidance and information necessary for success.

Contractors will be encouraged to meet with the trainees on a daily basis to ensure the instruction they are receiving is sufficient. In addition, Engineering Project Managers have been asked to spend at least 10 minutes each week with the trainee.

Trainee retention and attrition factors are mentioned as a possible area for improvement. Unfortunately, recruitment and retention is a state-wide issue for positions of this nature. In an effort to improve the retention of trainees, CRB will inquire if contractors have retention policies in place. This will be reviewed during the compliance review of the contractor. Contractors will also be encouraged to conduct exit interviews when trainees leave employment to ascertain the reasons and implement appropriate problem solving processes to reduce attrition.

CRB will create an informational flyer for use by contractors outlining their obligations to the OJT program.

Finally, the review discussed the on-going issue of discrimination. Consistent with the Contract Special Provisions contained in Federal Highway Administration (FHWA) Form 1273, contractors' Equal Employment Opportunity (EEO) officers will be encouraged to visit the trainee periodically to determine if they have experienced any discrimination in their work environment. Complaint procedures must also be in place in accordance with FHWA Form 1273. EEO officers are required to ensure all trainees are aware of the procedures. CRB will ensure these procedures exist and are communicated during the review of the contractor.

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2.2.2.2 Motor Fuel Tax Evasion in the State of Montana

Project Number:	8180
Start Date:	8/1/04
Completion Date:	6/30/07
Total Cost:	\$218,130
SPR Funds:	\$218,130
FFY 2007 Funds Expended:	\$5,909
Unexpended Funds:	\$0
Status:	Complete
Contractor:	Battelle
URL:	http://www.mdt.mt.gov/research/projects/admin/evasion.shtml

Objective:

The objective of this project was to develop a comprehensive document to determine the origin, extent, and cost of fuel tax evasion in the state of Montana. Revenues from motor fuel are used primarily to support Montana's transportation system. Ensuring all motor fuel tax funds are collected, remitted, and credited to the Highway Special Revenue Account is a priority, but evasion of these taxes has proven to be a problem. Changes in legislation and increased enforcement and audit efforts have increased monies to the Highway Special Revenue Account. However, the extent of the loss and the processes involving this loss of revenue from fuel tax evasion was not known in Montana. For the Montana Department of Transportation to efficiently direct its allocation of resources, it was imperative to determine the origin and extent of fuel tax evasion.

Progress:

All research is complete.

Reports:

The final report was published, distributed, and can be viewed at the above URL.

Implementation:

The Divisions involved with motor fuel tax reporting, auditing, evasion, and enforcement will use this report's recommendations to increase the efficiency and effectiveness of the existing motor fuel program. The recommendations of performing more distributor audits and maintaining the distributor education program is being implemented with MDT management's support. Also, other recommendations that don't require legislation, such as reviewing the Power Take-Off (PTO) rate schedules and increasing third party reporting of fuel are being implemented. Recommendations requiring legislation, such as the statute of limitations, piercing the corporate veil,

expanding penalties, and fines for non-compliance will be presented to MDT management for the 2009 legislative consideration.

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2.2.2.3. Montana Air Service: Opportunities and Challenges

Project Number:	8185
Start Date:	1/1/05
Completion Date:	2/28/07
Total Cost:	\$240,199
SPR Funds:	\$240,199
FFY 2007 Funds Expended:	\$9,186
Unexpended Funds:	\$0
Status:	Completed
Contractor:	Wilbur Smith Associates (WSA)
URL:	http://www.mdt.mt.gov/research/projects/aer/air_challenges.shtml

Objective:

A historical framework and trend analysis was followed by an assessment of the opportunities and challenges facing Montana in terms of growth and improvement in air service. Airport infrastructure needs, intermodal concerns, and long-range transportation policy issues were identified as they relate to development of a strategy for air service enhancements. Finally, a statewide marketing strategy was prepared that documents specific areas for improvements. The strategy was clearly defined with responsibilities and potential costs assigned to implement the improvements in achieving a higher level of air service. Performance measures were developed that can be used to monitor the performance of the strategy as changes occur in the future.

Progress:

All research is complete.

Reports:

The final report was published, distributed, and can be viewed at the above URL.

Implementation:

The study has established work plan options for state and local entities. Approaches used by other states to improve air service will be taken into account. Some of the recommendations are in place today. These efforts will be continued and expanded where achievable. Other suggestions including public/private partnerships will be reviewed for development. Local agencies and facilities will assess alternatives that require a funding source and consider those options where feasible.

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2.2.3 Contracted Projects

2.2.3.1 Industry Best Practices for Application Development Processes

Project Number:	8117-25
Start Date:	5/1/05
Completion Date:	11/30/07
Total Cost:	\$23,460
SPR Funds:	\$0
State Funds:	\$23,460
FFY 2007 Funds Expended:	\$0
Unexpended Funds:	\$5,854
Status:	Contracted
Contractor:	Montana State University
URL:	http://www.mdt.mt.gov/research/projects/admin/app_dev.shtml

Objective:

The Industry Accepted Best Practices and Methodologies checklists, process metrics, and templates for each step of the software development life cycle (SDLC) are not readily available from one source, but could be cooperatively collected through numerous professional sources and universities. This proposed research will involve the compilation and synthesis of this information as it pertains to the standard SDLC for MDT.

Progress:

Due to principal investigator illness, this project has been delayed. All research has been completed. The final report is in review and should be finished early FFY 2008.

Reports:

No progress reports were received in FFY 2007 as the final report was being drafted. The final report was completed early in FFY 2008 and can be viewed at the above URL.

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Contractor Project Manager:

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2.2.3.2 Evaluation of MDT's Research Project Solicitation, Prioritization, and Selection Processes

Project Number:	8117-29
Start Date:	9/13/05
Completion Date:	1/31/08
Total Cost:	\$27,021
SPR Funds:	\$23,351
Contractor Cost Share:	\$4,670
FFY 2007 Funds Expended:	\$233
Unexpended Funds:	\$0
Status:	Contracted
Contractor:	The University of Montana
URL:	http://www.mdt.mt.gov/research/projects/admin/research_eval.shtml

Objective:

The Montana Department of Transportation needs information about the research solicitation, prioritization, and selection process used by peer Departments of Transportation from around the United States. Obtaining this information is an important step in MDT's process of maintaining and improving the quality of its Research Projects Process. This research involves reviewing the web sites and hard copy publications of MDT's peer research organizations, conducting a web-based survey with key research staff in MDT's peer organizations, conducting in-depth interviews with selected key informants from MDT's peer organizations, and conducting in-depth interviews with selected key informants from within MDT to gather this information.

Progress:

All research has been completed. The final report is in review and should be finished early FFY 2008.

Reports:

No progress reports were received in FFY 2007 as the final report was being drafted. Project information can be viewed at the above URL.

MDT Project Manager:

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Contractor Project Manager:

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2.2.3.3 Business Market Analysis

Project Number: 8187
Start Date: 11/1/06
Completion Date: 3/31/08
Total Cost: \$77,784
SPR Funds: \$77,784
FFY 2007 Funds Expended: \$77,527
Unexpended Funds: \$256
Status: Contracted
Contractor: NewWest Strategies
URL: http://www.mdt.mt.gov/research/projects/admin/business_market.shtml

Objective:

The objective of this project is to determine what opportunities are available for a new or expanding business in Montana highway construction and consulting industries through the Montana Department of Transportation (MDT). The information provided by this study would help the DBE Supportive Services (Disadvantaged Business Enterprise) program within the Department inform subcontractors and subconsultants of these identified opportunities, requirements, and challenges.

Progress:

All research is complete. The final report is being drafted

Reports:

Three progress reports were submitted. The draft final report is in progress.

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Contractor Project Manager:

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2.2.3.4 Disparity/Availability Study

Project Number: 8190
Start Date: 4/1/07
Completion Date: 8/31/08
Total Cost: \$675,784
SPR Funds: \$675,784
FFY 2007 Funds Expended: \$301,857
Unexpended Funds: \$370,854
FFY 2007 MDT Indirect Costs: \$23,978
Status: Contracted
Contractor: D. Wilson Consulting Group
URL: <http://www.mdt.mt.gov/research/projects/admin/disparity.shtml>

Objective:

The purpose of this research project is to determine the extent to which barriers exist that impact small, disadvantaged businesses' ability to participate in federally assisted contracting opportunities in the transportation industry in Montana.

Progress:

The legal analysis is complete and will be updated prior to drafting the final report. MDT's policies, procedures, and programs were reviewed and a draft report submitted. On-site data collection is complete. The data is being cleaned and formatted. The telephone survey was finalized. The personal interview questions were drafted. Personal interview and public hearing dates and locations were set and planning initiated.

Reports:

Five progress reports were submitted and can be viewed at the above URL.

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2.3 BRIDGE AND HYDRAULICS RESEARCH PROJECTS

2.3.1 Completed Projects

2.3.1.1 High Performance Concrete: Phase IV Specification Development and Implementation

Project Number:	8156-003
Start Date:	7/1/06
Completion Date:	4/30/07
Total Cost:	\$30,000
SPR Funds:	\$20,000
Bridge Bureau Cost Share:	\$10,000
FFY 2007 Funds Expended:	\$11,825
Unexpended Funds:	\$8,175
Status:	Complete
Contractor:	Wiss, Janney, Elstner Associates, Inc./HDR Inc.
URL:	http://www.mdt.mt.gov/research/projects/mat/high_concrete.shtml

Objective:

To maximize the efficiency of the construction process, a performance-based concrete special provision was developed. This type of specification allows the contractor great flexibility to meet the job requirements in a manner that is least expensive for the state and targeted at producing the best final product. However, since short-term testing is not adequate to assess all aspects of long-term durability and to best implement the developmental work already completed, some guidelines for the mix designs were specified.

This specification includes each step in the process for submittals, approval, and implementing high performance mixtures that include supplementary cementitious materials (SCM's). Also, the specification includes provisions covering raw material prequalification for cement, SCM's, and aggregates. A trial placement was specified to allow the assessment of the batching, mixing, transporting, placing, and finishing of the high performance concrete (HPC). The parameters of a trial batching and trial placement for contractors who have not used the proposed concrete mixture on a previous MDT job and for those that have successfully used the mixture on a previous MDT job were outlined.

The individual performance components of the hardened concrete included:

- Compressive strength,
- Abrasion resistance,

- Free drying shrinkage,
- Rapid chloride permeability,
- Chloride diffusion coefficient, and
- Parameters of the air void network.

Progress:

The HPC specifications were submitted and can be viewed at the above URL.

Implementation:

MDT is in the process of reviewing the HPC draft specifications for practical application to Montana bridge decks. This review will include the testing of specifications on selected decks in collaboration with the cement suppliers, concrete producers, and contractors to insure reasonable compliance of the specification in determining the acceptability of the durability and material properties of the cast-in-place HPC deck.

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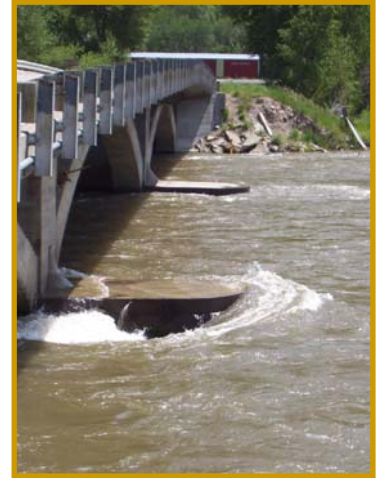
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2.3.2 Contracted Projects

2.3.2.1 Evaluation Methods of Estimation of Bridge-Pier Scour for Streams with Coarse Bed Materials Based on Observed Scour in Montana

Project Number:	8154
Start Date:	7/1/00
Completion Date:	12/31/07
Total Cost:	\$322,721
SPR Funds:	\$161,826
Contractor Cost Share:	\$160,895
FFY 2007 Funds Expended:	\$31,331
Unexpended Funds:	\$10,375
FFY 2007 MDT Indirect Costs:	\$931
Status:	Contracted
Contractor:	United States Geologic Survey
URL:	http://www.mdt.mt.gov/research/projects/hyd/bridge_scour.shtml



Objective:

The overall objective of this project is to improve pier-scour estimates at bridges in Montana. To this end, this project has two major components. The first component is an analysis of existing bridge-scour data in Montana and adjacent mountain states similar to the comparison study done on a national basis. The second component is a long-term pier-scour data collection program for bridges over coarse-bed streams throughout Montana. The goal is to obtain on-site pier-scour measurements at selected sites per year over a 5-year period.

Progress:

All research is completed. The final report is being drafted.

Reports:

Two semiannual progress reports were received and can be viewed at the above URL. The final report is being drafted.

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2.4 ENVIRONMENTAL RESEARCH PROJECTS

2.4.1 Completed Projects

2.4.1.1 Habitat Connectivity and Rural Context Sensitive Design: A Synthesis of Practice

Project Number:	8117-31
Start Date:	11/1/05
Completion Date:	2/28/07
Total Cost:	\$24,923
SPR Funds:	\$19,938
Contractor Cost Share:	\$4,985
FFY 2007 Funds Expended:	\$4,513
Unexpended Funds:	\$7,454
Status:	Complete
Contractor:	Western Transportation Institute, Montana State University
URL:	http://www.mdt.mt.gov/research/projects/env/habitat.shtml

Objective:

A group of inter-related issues drove the need for increased knowledge about context sensitive solutions and context sensitive design (CSS/CSD) for rural transportation infrastructure including: 1) planning and management of land use (especially determining how transportation relates to other planning and management efforts), 2) preserving the rural nature through roadside design, and 3) preserving wildlife habitat connectivity and minimizing wildlife/vehicle collisions.

The objective of this project was to identify beneficial practices (including programs, design elements, or operations) used within comparable regions to Montana (intermountain west) that target at a minimum known strategic issues facing the department. These strategic issues include, but are not limited to: system-level planning requirements for habitat protection, traveler safety, improvements to habitat connectivity, and perpetuation of community character and links to local land-use decisions.

Although many transportation studies have been conducted to determine context sensitive solutions and help mitigate interactions between vehicles and wildlife, little work had been done to synthesize this information in a concise and meaningful way that is applicable to transportation in Montana. Therefore, the primary objective of this

project was to synthesize the abundance of information applicable to transportation planners at the Montana Department of Transportation. This synthesis did not include recommendations or guidelines, but identified case studies and practices of other states related to sustainable transportation in Montana.

Progress:

All research is completed.

Reports:

The final report was completed, published, distributed, and can be viewed at the above URL.

Implementation:

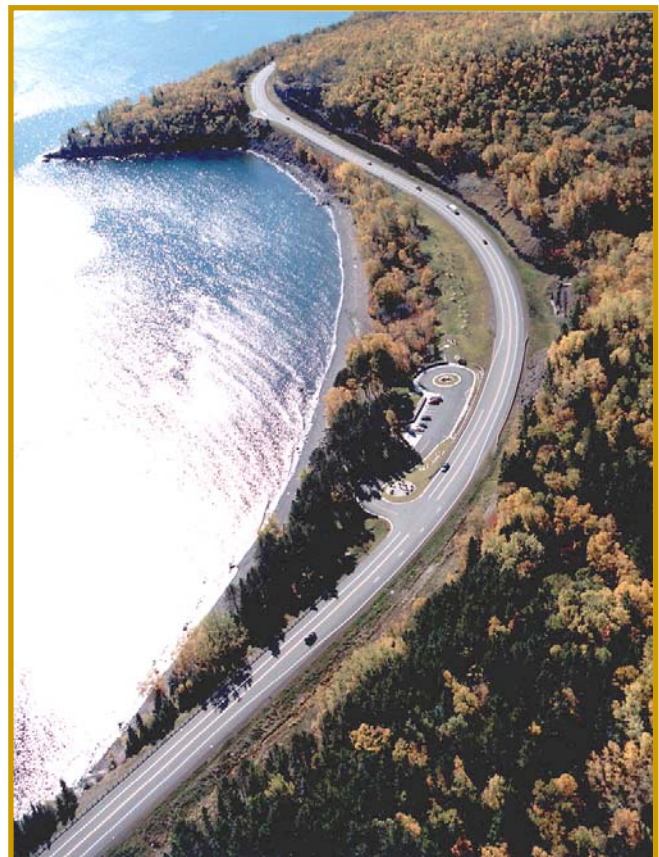
A context sensitive design committee will be established to review the results of this report, refine MDT's current policy, and determine where MDT future direction with regards to context sensitive design, including any further research.

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2.4.1.2 Wildlife-Vehicle Collision and Crossing Mitigation Measures: A Toolbox for the Montana Department of Transportation

Project Number:	8117-34
Start Date:	10/1/06
Completion Date:	5/31/07
Total Cost:	\$19,928
SPR Funds:	\$15,943
Contractor Cost Share:	\$3,986
FFY 2007 Funds Expended:	\$15,943
Unexpended Funds:	\$0
Status:	Complete
Contractor:	Western Transportation Institute, Montana State University

URL:http://www.mdt.mt.gov/research/docs/research_proj/wildlife_crossing_mitigation/final_report.pdf

Objective:

The purpose of this project was to provide an overview of mitigation measures that reduce wildlife-vehicle collisions and allow animals to cross the road safely. The overview was restricted to mitigation measures aimed at large terrestrial mammals (deer size and larger). Furthermore, each mitigation measure was not only described in general terms, but was also evaluated for its pros and cons regarding its effectiveness in increasing safety and habitat connectivity, its appropriate use and restrictions, construction costs, and maintenance costs, if data were available.

Progress:

All research is complete.

Reports:

The final report was completed, published, distributed, and can be viewed at the above URL.

Implementation:

Through this synthesis research, MDT obtained a toolkit of multiple options to prevent animal-vehicle collisions incorporated into projects through out the world. This research also shows the options are extremely limited. To date, there is very little known about the effectiveness of many of these options. None-the-less, this research

will assist MDT in better assessing our risk and making the most informed decision when deciding to incorporate a feature to reduce animal vehicle collisions into a project.

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2.4.1.3 Potential Effects of Highway Mortality and Habitat Fragmentation on a Population of Painted Turtles in Montana

Project Number: 8169
Start Date: 4/15/02
Completion Date: 10/31/06
Total Cost: \$178,624
SPR Funds: \$178,624
FFY 2007 Funds Expended: \$0
Unexpended Funds: \$5,399
Status: Complete
Contractor: The University of Montana
URL: http://www.mdt.mt.gov/research/docs/research_proj/turtle/final_report.pdf

Objective:

Highways and other road systems can present problems to wildlife populations by decreasing habitat quality, increasing habitat fragmentation, altering animal behavior, and also through direct highway mortality. U.S. Highway 93, a major north-south highway that bisects a network of wetlands, is currently being reconstructed and may include some areas of expansion from 2 to 3 lanes. This reconstruction project has the potential to fragment wildlife populations. Semi-aquatic turtles are especially vulnerable to fragmentation because they have limited abilities to move effectively between isolated patches though they use terrestrial landscapes for nesting and seasonal movements.

Although the painted turtle (*Chrysemys picta*) is not listed as a threatened species, wildlife managers, tribal biologists, and the general public have all expressed concern that highways create significant barriers to movement and sources of mortality for turtles, resulting in fragmented populations and lowered population viability. The issue of turtle road mortality has been raised at virtually every public meeting regarding the reconstruction project. Safety concerns were also raised due to automobiles braking and swerving as a result of turtles on the highway. Although freshwater turtles have presumably declined in abundance due to habitat loss and fragmentation, few quantitative studies of such a relationship have occurred. This research addressed the potential effects of fragmentation due to the highway on turtle populations and movements. This research also addressed management needs by providing information to decrease the perceived barrier of a highway via the design and placement of wildlife crossing structures.

Progress:

All work is complete.

Reports:

The final report was completed, published, distributed, and can be viewed at the above URL.

Implementation:

MDT will carry the following recommendations forward to and coordinate with the design team and Tribal staff:

- Construct bridges or over-sized cement box or metal culverts in the high priority areas that naturally would be water crossings. In particular, these should be placed in the 2 kettle ponds.
- Construct over-sized cement box culverts in dry crossing areas such as near the scenic turn-out at Beaverhead Lane and just north of Olson Road. Dry land culverts should be flat bottomed with an earthen substrate to facilitate turtle terrestrial movements through them.

Although MDT cannot minimize construction when turtle movements are highest from mid-May to mid-July, MDT will monitor during that period and create special provisions for temporary fencing to redirect the turtles to minimize disturbance and mortality. To provide safe turtle passage, MDT also will monitor construction in the kettle ponds due to their importance in overwinter, reproduction, and refugia habitat. MDT will coordinate detour location and monitoring with the design team and Tribal staff. MDT can likely oversize culverts in the detour as well.

MDT will coordinate with the design team and tribal staff to install directional fencing to funnel turtles to the culverts. The fencing would be necessary only in the vicinity of the crossing structures and nesting areas.

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2.4.1.4 Evaluation of Organic Matter Compost Addition and Incorporation in Steep Cut Slopes: Phase II Test Plot Construction and Performance Monitoring

Project Number: 8176
Start Date: 8/19/03
Completion Date: 4/30/07
Total Cost: \$118,007
SPR Funds: \$118,007
FFY 2007 Funds Expended: \$11,835
Unexpended Funds: \$0
Status: Complete
Contractor: Montana State University
URL: http://www.mdt.mt.gov/research/projects/env/organic_matter.shtml

Objective:

Fundamental to successful revegetation of highway corridors following disturbance is the creation of a growth environment conducive to the establishment and early survival of the seeded plants. Steep cut slopes present a unique problem. The steepness of cut slopes prevents practical replacement of salvaged topsoil with conventional equipment. The current remedy is simply to broadcast seed and hydromulch the bare slope. These techniques all too often result in marginal plant establishment since germination and initial seedling survival is limited by nutrient poor, rocky substrates characteristic of cut slopes. The resulting poor vegetation establishment leads to increased erosion and sedimentation, occasional slope failure, increased noxious weed growth, and low aesthetic quality. All of these factors except the latter can be expected to substantially increase maintenance costs in the affected areas.

Several types of geologic parent material have been identified in Montana that causes recurrent maintenance problems for MDT when encountered on steep cut slopes. Alluvial rock, glacial till, and marine shale are exposed in road cuts in many areas within the State. Glacial till and alluvial rock are common in western Montana while marine shale is common in eastern Montana. In all three cases limited vegetation has developed following seeding into nutrient poor parent material. Significant erosion has resulted, especially from the glacial till and marine shale deposits. Roadside ditches have become clogged with eroded sediment leading to increased maintenance costs and long-term concern for road base stability. Road base aggregate can become saturated as drainage ditches fail to operate properly leading to frost heaving of bituminous overlays. Amendment of steep cut slopes with organic matter may lead to improved vegetation condition, decreased erosion, and reduced maintenance cost.

The objectives of Phase II were to: 1) construct test plots on steep highway cut slopes with erosive and/or poorly vegetated parent material; 2) evaluate equipment and

develop protocols for application and incorporation of compost on steep cut slopes; 3) monitor and evaluate test plots on steep highway cut slopes; and 4) communicate, report and provide technology transfer of the research findings.

Progress:

All work is complete.

Reports:

The final report was completed, published, distributed, and can be viewed at the above URL.

Implementation:

MDT has initiated changes in its reclamation program that reflect the findings and recommendations from this research. Compost is incorporated in mulching specifications on slopes too steep for retopsoiling. The addition of compost has enhanced the establishment of desirable vegetation on sites that previously were extremely difficult to revegetate because of hostile growing conditions. The development of vegetation cover on the slopes has in turn reduced sediment loss and gully formation in our roadside ditches.

Note:

A Phase III project was moved forward to the technical panel stage. The Technical Panel met once and is developing a scope of work (see Section 2.4.3.2).

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2.4.1.5 Fish Passage at Road Crossings in Montana Watersheds Providing Bull and Cutthroat Trout Habitat: Phase II Passage Goals

Project Number:	8181
Start Date:	8/23/04
Completion Date:	6/30/07
Total Cost:	\$149,166
SPR Funds:	\$149,166
FFY 2007 Funds Expended:	\$22,873
Unexpended funds:	\$0
Status:	Complete
Contractor:	Montana State University
URL:	http://www.mdt.mt.gov/research/projects/env/fish_passage.shtml

Objective:

Culverts are a common and often cost effective means of providing transportation intersections with naturally occurring streams or rivers. Fish passage and fish habitat considerations are now typical components of the planning and design of waterway crossings. Many culverts in Montana span streams that support diverse fisheries. The health of these fisheries is an essential element of a recreational industry that draws hundreds of thousands of visitors to Montana annually. Transportation system planners, designers, and managers recognize fish passage through Montana's culverts is a concern. However, there is much contention concerning the impact a culvert can have on a fishery. Recent basin-wide studies in Montana (Phase I of this project - final report in November 2004, see above URL) indicate the tools some planners and designers promote for forecasting fish passage concerns may be overly conservative. This is reflected in the diversity of fish passage goals being considered by state agencies in the Northwest. Some managers contend all culverts should pass all fish at all times, whereas others suggest this is an unrealistic criterion, particularly during high flow events. Which species, life stages, and how many individuals must have fish passage access for how long, are questions often brought forward during discussions on the design and retrofitting of culverts to accommodate fish passage concerns. The problem is that for fish species and settings in Montana, the timing and number of fish that must pass a culvert to maintain viable species diversity in the watershed is unknown. The primary objective of this study was to determine the rate and timing of fish passage in culverts desirable for species diversity maintenance.

Progress:

All work is complete.

Reports:

The final report was completed, published, distributed, and can be viewed at the above URL.

Implementation:

Implementation is currently in review and discussion.

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2.4.1.6 Warm Water Species Fish Passage in Eastern Montana Culverts

Project Number: 8182
Start Date: 8/23/04
Completion Date: 6/30/07
Total Cost: \$185,846
SPR Funds: \$185,846
FFY 2007 Funds Expended: \$55,736
Unexpended Funds: \$0
Status: Complete
Contractor: Montana State University
URL: http://www.mdt.mt.gov/research/projects/env/fish_passage_warm.shtml

Objective:

Culverts are a common and often the most cost effective means of providing transportation intersections with naturally occurring streams or rivers. Fish passage and fish habitat considerations are now typical components of the planning and design of waterway crossings. Many culverts in Montana span streams that support diverse fisheries. The health of these fisheries is an essential element of a recreational industry that draws hundreds of thousands of visitors to Montana annually. Additionally, there is growing recognition of the value of native Montana species, some of which are considered 'species of special concern' in the state. In recent years these concerns have become apparent for warm water species in low gradient, high sediment bearing, intermittently flowing streams that are typical of eastern Montana.

Transportation system planners, designers, and managers recognize fish passage through Montana's culverts is a concern. However, there is much contention concerning the impact a culvert can have on a fishery. Recent basin-wide studies of various trout species conducted in western Montana indicate the tools some planners and designers promote for forecasting fish passage concerns may be overly conservative. Which species, life stages, and how many individuals must have fish passage access for how long, are questions often brought forward during discussions on the design and retrofitting of culverts to accommodate fish passage concerns. The problem is that for warm water fish species and settings in eastern Montana, the timing and number of fish that must pass a culvert to maintain viable species diversity in the watershed is unknown, and the physiologic abilities of these species relative to such common fish passage questions are often unknown.

The primary objective of this study was to determine the rate and timing of fish passage in culverts that is desirable for warm water species diversity maintenance in eastern Montana.

Secondary goals were to discover fish passage issues for these species that may not be predictable from hydraulic analysis and to refine information about the physiologic abilities of these species to pass through culverts.

Progress:

All work is complete.

Implementation:

Implementation is currently in review and discussion.

Reports:

The final report was completed, published, distributed, and can be viewed at the above URL.

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2.4.2 Contracted Projects

2.4.2.1 Evaluation of Wildlife Crossing Structures on US Highway 93 Evaro to Polson

Project Number:	1744
Start Date:	2/9/02
Completion Date:	1/31/08
Total Cost:	\$597,700
SPR Funds:	\$147,700
Federal Funds:	\$450,000
FFY 2007 Funds Expended:	\$12,926
Unexpended Funds:	\$694
Status:	Contracted
Contractor:	Western Transportation Institute, Montana State University
URL:	http://www.mdt.mt.gov/research/projects/env/wildlife_crossing.shtml

Objective:

In December 2000, the Confederated Salish and Kootenai Tribes (CSKT), the Federal Highway Administration (FHWA), and the Montana Department of Transportation (MDT) agreed to reconstruct 90 km of US Highway 93 on the Flathead Indian Reservation, Montana. The reconstruction discussions and plans focused on improving driver safety and preserving the natural and cultural heritage of the CSKT.

The plans include 41 wildlife crossing structures to provide safe animal passage under, and in one case over, the highway. In addition, there will be 15 km of wildlife exclusion fencing to reduce animals from accessing the roadway and to funnel movements to these crossings, at an estimated cost of \$9 million for all of these installations. This effort is unprecedented in North America and provides an opportunity to study the effectiveness of wildlife crossing and fencing structures in a landscape that accommodates not only wildlife, but also agricultural, residential, business, recreational, and cultural activities.

The Western Transportation Institute (WTI) at Montana State University is evaluating the effectiveness of the US 93 wildlife crossing structures and developing best management practices that can be applied to future projects. The goal of the evaluation is to quantify the effect the mitigation efforts have on the following two parameters: 1) animal-vehicle collisions and 2) wildlife movements across US 93, with a focus on deer species and black bear. Effectiveness will be defined *a priori* and will ultimately be determined based on a comparative analysis of pre- and post-construction animal-vehicle collisions and animal crossings of the highway.

Progress:

All work on the preconstruction evaluation project is complete. The project was extended to allow the preparation of a post construction proposal. This proposal is due early in FFY 2008.

Reports:

The final report was completed, published, distributed and can be viewed at the above URL.

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2.4.2.2 Preventing Adverse Effects from Highway Noise: A Toolkit for Local Planners

Project Number:	8117-36
Start Date:	3/31/07
Completion Date:	2/29/08
Total Cost:	\$7,825
SPR Funds:	\$7,825
FFY 2007 Funds Expended:	\$4,725
Unexpended Funds:	\$3,100
Status:	Contracted
Contractor:	Headwaters Policy/Planning Partnership and Wyatt Design
URL:	http://www.mdt.mt.gov/research/projects/env/noise_plan.shtml

Objective:

The purpose of this project is to develop a user-friendly booklet designed to help and encourage local Montana governments to incorporate noise compatibility into their land use planning. The document will be modeled after a similar report produced by the South Dakota Department of Transportation (*Tools for Preventing Adverse Effects from Highway Noise: A State and Local Partnership Approach*).

Progress:

The booklet was drafted. It is currently being reviewed and will be sent to the graphic designer early in FFY 2008.

Reports:

Two progress reports were received. Information on this project can be viewed at the above URL.

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2.4.2.3 Bozeman Pass Wildlife Linkage and Highway Safety Pilot Study

Project Number:	8173
Start Date:	2/28/03
Completion Date:	5/31/10
Total Cost:	\$97,498
SPR Funds:	\$82,498
FFY 2007 Funds Expended:	\$0
Contractor Cost Share:	\$15,000
Unexpended Funds:	\$57,442
Status:	Contracted
Contractor:	Western Transportation Institute, Montana State University
URL:	http://www.mdt.mt.gov/research/projects/env/boz_wildlife.shtml

Objective:

Two different but related wildlife research projects on Interstate 90 at Bozeman Pass between Bozeman and Livingston, Montana are currently being conducted.

The first project, Bozeman Pass Wildlife Linkage and Highway Safety Pilot Study will evaluate the effectiveness of wildlife fencing that will be installed at the Montana Rail Link (MRL) overpass on I-90 near Bear Canyon. Data on wildlife crossings and animal-vehicle collisions will be collected before and after installation of the fencing in order to evaluate if the fencing reduces animal-vehicle collisions, as well as if animals maintain movements across the transportation corridor by traveling under I-90 through existing culverts and the MRL overpass.

The objective of the second project is to test the use of Intelligent Transportation Systems (ITS) in addressing wildlife-vehicle conflicts on Bozeman Pass (Intelligent Transportation System Deployment Program Project Identification Number VIL.H.24, entitled "Bozeman Pass Wildlife Channelization ITS Project"). Intelligent Transportation Systems are advanced technologies (such as highway advisory radio or electronic message signs) that can be installed on roads to improve safety or address other transportation issues that affect drivers. This project will address whether wildlife advisories on automated roadside message signs may help reduce animal-vehicle collisions. This effort includes a speed study and driver survey to quantify potential effects that wildlife advisory messages may have on speed and driver behavior. In addition, a driver simulator study will test how drivers respond to wildlife advisory messages, as well as how their speed influences the occurrence of an animal-vehicle collision.

Together, these two projects will provide a better understanding of the effectiveness of highway construction options and traveler information methods in reducing wildlife-transportation conflicts on Bozeman Pass. This information can be used for long term planning efforts to ensure that future highway construction promotes both wildlife protection and traveler safety.

The first study is contracted through the MDT Research Programs.

Progress:

Data management and reporting, road kill surveys, and track bed, photo, and infrared counter monitoring occurred as part of post-construction monitoring in FFY 2007.

Reports:

Six progress reports were received. These reports and other project information can be viewed at the above URL.

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2.4.3 Pending Projects

2.4.3.1 Development of Wildlife Crossing Structures for Small and Large Species and Analysis of their Effectiveness

The technical panel developed the following scope of work. An RFP was issued. A contractor will be chosen early in FFY 2008. A preliminary statistical analysis to determine research parameters was conducted to assist in scope development.

Purpose:

The purpose of this project is to determine the effectiveness of animal crossing structures and associated wildlife fencing in providing improved public safety and permeable roadways by investigating animal-vehicle collisions and animal crossing structure usage before and after construction. White-tailed deer is the species of focus for this investigation; however, it is likely that data on other species will also incidentally be collected and may be useful.

Tasks:

- All work should be conducted in a rigorous statistical manner.
- All work should be consistent with US 93 North research so that at a later date, the two data sets can be combined to enhance the data evaluation. The comparison of US 93 South and North data sets is not a part of this research. If deviations from the research conducted on US 93 North are proposed, explain why and the impact these deviations will have on combining the two data sets for future evaluation. See http://www.mdt.mt.gov/research/projects/env/wildlife_crossing.shtml for more information.
- The proposal should include a discussion of how the offeror will limit data loss due to faulty equipment, etc.
- Determine changes in animal vehicle collisions (AVC's) before and after construction for an approximate 25 mile (MP 49 to 74.3) stretch (or portions thereof) of US 93 South. This analysis will be conducted to a high spatial and temporal resolution analysis and should take into account the following:
 - Amount of traffic throughout the evaluation period and
 - White-Tailed deer population, including harvests and hunts throughout the evaluation period.
- Determine if there is a relationship between changes in AVC's and locations of crossing structures before and after construction for an approximate 12 mile (MP 53.7 to 65.94) stretch of US 93 South. Are there AVC "hotspots"? If so, did these "hotspots" change after construction?
- Determine usage rates by structure and across structures.

- Determine any significant relationships between usage rates and landscape and structure features, such as length, width, openness, and any other aspects of the structures.
- Data should be collected at least three years pre- and post-construction. Post-construction evaluation does not necessarily need to begin immediately following construction. Offeror should recommend methods and timeframes in proposal with justification.

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2.4.3.2 Compost Application for Optimized Vegetation Response

The following research problem statement discusses possible follow-on (Phase III) work to the project *Evaluation of Organic Matter Compost Addition and Incorporation in Steep Cut Slopes: Phase II Test Plot Construction and Performance Monitoring* (see section 2.4.1.4). The Technical Panel met once and is in the process of developing a scope of work.

Problem Statement:

Revegetation of roadside disturbances has proven difficult when inhospitable growth media has been encountered. Recognizing that compost application may dramatically improve vegetation development, MDT contracted with Montana State University (MSU) Reclamation Research Unit to perform a research investigation evaluating compost application and incorporation on steep cut slopes. This research project was initiated during 2003. Several research plots were constructed near Happys Inn on U.S. 2 and near Miles City on U.S. 12. Summer 2004 was the first growing season for all the research plots. Vegetation response spanned a wide range from robust vegetation development on the compost treated plots at Happys Inn to incipient vegetation growth at the Miles City research site. The problems observed with compost application technologies are two-fold. First, the rate of application has not been optimized to minimize cost. Two application rates were applied during construction of research plots; a 1 inch and 2 inch layer. In the high moisture regime of northwest Montana, plants flourished in both treatments. It is probable that a lesser application rate can achieve acceptable vegetation results, and make the use of compost more attractive by virtue of reduced cost. A need exists to optimize application rates to reduce cost. Secondly, compost applied as a blanket at the Miles City research site was desiccated during the summer months reflecting drought conditions observed in eastern Montana. Concurrent wind removal of the compost prior to plant establishment diminished the potential treatment benefit. Substantial areas on the treated plots were negatively impacted by wind transport of applied compost. A need exists to develop techniques to stabilize compost and prevent wind effects.

In summary, development of compost amendment techniques show great promise for aiding in revegetation of difficult parent material along Montana transportation corridors. Preliminary results from existing test plots are very promising. Prior to adoption of compost-based revegetation prescriptions for large scale construction projects, optimization of the techniques employed and rates of application is required to address limitations observed. The compost application rate needs to be adjusted downward on sites with abundant rainfall to identify an optimal rate and techniques need to be developed to prevent compost blowing in wind-prone areas.

Research Proposed:

New research plots are proposed to optimize the compost application technology for Montana roadsides. The Four Corners-Madison River road corridor on Highway 84 is tentatively selected as a research site reflecting proximity to a compost supplier, proximity to Montana State University and sparsely vegetated roadcuts observed. Experimental plots will be constructed to evaluate compost application rates between 0 and 1 inch depths. The preliminary compost blanket thicknesses are 0, 0.25, 0.5, 0.75 and 1.0 inches. Vegetation response and erosional condition will be monitored. Similarly, experimental plots will be constructed evaluating several methods of stabilizing compost to prevent wind removal prior to vegetation establishment. The preliminary stabilization treatments include application of plastic netting, and use of liquid tacifiers. Compost retention and plant performance will be monitored for 3 years following implementation with emphasis placed on the critical first growing season.

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2.5 GEOTECHNICAL, MATERIALS, AND PAVEMENTS RESEARCH PROJECTS

2.5.1 Completed Projects

2.5.1.1 Preventative Maintenance Treatments: A Synthesis of Highway Practice

Project Number:	8117-26
Start Date:	5/15/05
Completion Date:	10/31/06
Total Cost:	\$25,000
SPR Funds:	\$20,000
Contractor Cost Share:	\$5,000
FFY 2007 Funds Expended:	\$0
Unexpended Funds:	\$0
Status:	Complete
Contractor:	Western Transportation Institute, Montana State University

URL:

http://www.mdt.mt.gov/research/docs/research_proj/prevent_maint/final_report.pdf

Objective:

Preserving and maintaining Montana's transportation infrastructure is a necessary, but costly endeavor. To ensure that preventive maintenance and rehabilitation of flexible pavements is cost effective, periodic evaluations of various preservation treatments are necessary. Although studies have been conducted to evaluate timely and cost effective treatments, it is not known how these treatments enhance or extend pavement performance under Montana's climate, traffic loads, and soil conditions. Therefore, the primary objective of this study was to identify existing and emerging technologies that could be used to enhance or even replace current approaches used by the Montana Department of Transportation. An extensive review and synthesis of past and ongoing research determined the current state of practice in regards to pavement preservation treatments (including methods and materials).

Progress:

All work is complete.

Reports:

The final report was completed, published, distributed, and can be viewed at the above URL.

Implementation:

The information gathered in this synthesis project is being used to improve preventative maintenance in Montana.

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2.5.1.2 Comparative Analysis of Coarse Surfacing Aggregate using the Micro-Deval, L.A. Abrasion, and Sulfate Soundness Tests

Project Number:	8117-27
Start Date:	9/1/05
Completion Date:	2/28/07
Total Cost:	\$23,323
SPR Funds:	\$18,082
Contractor Cost Share:	\$5,242
FFY 2006 Funds Expended:	\$2,214
Unexpended Funds:	\$0
Status:	Complete
Contractor:	Western Transportation institute, Montana State University
URL:	http://www.mdt.mt.gov/research/projects/mat/coarse_aggregate.shtml

Objective:

Ensuring that quality aggregates are used in the construction of pavement structures is important. Standard tests are available to determine pertinent strength parameters to ensure that aggregates are both strong and durable. Only limited work has been done to compare the results from other standard tests, such as the L.A. Abrasion and Sulfate Soundness tests. Therefore, the primary objective of this study was to determine whether the Micro-Deval test can be used to replace the Sulfate Soundness tests.

Progress:

All work is complete.

Reports:

The final report was completed, published, distributed, and can be viewed at the above URL.

Implementation:

MDT has concluded the Micro-Deval test is a suitable replacement for the Sulfate Soundness test when evaluating aggregate durability. MDT is in the process of developing an implementation strategy to transition from the Sulfate Soundness test to the Micro-Deval for aggregate source approval.

The Department is working to develop the necessary specifications and procedures. The implementation process will be presented to the contracting and consulting communities for comment prior to implementation. MDT anticipates including the new specification in all contracts starting with the May 2007 letting. A transition period of one year is expected.

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2.5.1.3 Experimental Assessment of Aggregate Surfacing Materials

Project Number: 8117-30
Start Date: 11/1/05
Completion Date: 7/31/07
Total Cost: \$41,000
SPR Funds: \$25,724
Contractor Cost Share: \$15,276
FFY 2007 Funds Expended: \$2,885
Unexpended Funds: \$0
Status: Complete
Contractor: Western Transportation Institute, Montana State University
URL: http://www.mdt.mt.gov/research/docs/research_proj/exp_assess/final_report.pdf

Objective:

Highway base courses are typically constructed using crushed and processed aggregate. Roadway designers currently have a number of options for specifying the base course material on Montana Department of Transportation (MDT) highway projects. The engineering characteristics of these various options have not been thoroughly investigated or quantified by MDT; consequently, the designer must rely on experience and habitual practices. This approach often leads to inconsistencies in design and occasionally misunderstandings between designers, contractors, and materials personnel in regards to aggregate specifications.

The two most common options for untreated base course aggregates are described in Section 701.02.4 of the Montana Supplemental Specifications. These materials are known as crushed base courses (CBC). Based on the particle gradation, the two options for untreated base course are: 1) CBC Type A Grade 5 or 2) CBC Type A Grade 6. The maximum allowable particle size for Grade 5 and 6 are 2 in and 1.5 in, respectively.

On some projects, a finer-grained leveling course is substituted for the top 0.15 ft of base course to facilitate leveling and finishing earthwork activities. It is theorized that the smoothness of the finished AC roadway surface is in part a function of the smoothness of the underlying base course surface. Aggregate used for the finer grained leveling course is specified in Section 701.02.6 of the Montana Supplemental Specifications as Crushed Top Surfacing (CTS) Type A. The specifications provide five different particle gradation options for CTS, ranging from a 1-inch-minus to a 3/8-inch-minus maximum particle size. As requested by the Department, this study focused on the 3/4-inch-minus material specified as Grade 2 CTS.

This study examined the engineering characteristics of the following three materials: CBC Type A Grade 5 – designated in this proposal as CBC 5A, CBC Type A Grade 6 – designated in this proposal as CBC 6A, and CTS Type A Grade. The permissible gradation range of the three materials covers a wide band of particle sizes. Consequently, the performance and characteristics of the base course aggregates could vary widely because the engineering properties of granular cohesionless particles are largely a function of particle size distribution, particle shape, and particle surface texture.

The primary objective of this study was an experimental evaluation of the most important engineering properties and characteristics of three different types of base course aggregates. Designers would be in a better position to refine and optimize their pavement sections if the performance parameters of the most commonly used aggregates were better quantified. Having a better understanding of the engineering properties of the various aggregates options would alleviate confusion among designers and District personnel regarding differences in customary practices. It would also provide valuable information to construction personnel when faced with requests by contractors to change or modify aggregate types.

Progress:

All work is complete.

Reports:

The final report was completed, published, distributed, and can be viewed at the above URL.

Implementation:

The results of this research confirmed MDT's existing specifications and policies did not need revisions.

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2.5.1.4 Pavement Performance Prediction Models

Project Number:	8158
Start Date:	6/12/01
Completion Date:	9/30/07
Total Cost:	\$524,986
SPR Funds:	\$524,986
FFY 2007 Funds Expended:	\$47,041
Unexpended Funds:	\$0
FFY 2007 MDT Indirect Costs:	\$5,134
Status:	Complete
Contractor:	Fugro-BRE
URL:	http://www.mdt.mt.gov/research/projects/pave/pave_model.shtml

Objective:

The overall objective of this research was to develop a design process and performance/distress prediction models to enable the Montana Department of Transportation (MDT) to use mechanistic-empirical principles for flexible pavement design. The project involved a comprehensive performance monitoring and laboratory-testing program and spanned a period of five years.

Progress:

All work is complete.

Reports:

The final report was completed, published, distributed, and can be viewed at the above URL.

Implementation:

The MDT Design Team will adopt the recommendations of this report to provide more cost-effective pavement designs. The latest software version (1.000) of the MEPDG is in use at MDT and new designs using our existing method from AASHTO (DARWin, 1993) are being checked. Existing projects and the existing distresses are being compared to those predicted by the new Design Guide. Data from distress surveys, traffic, smoothness, rut depths, and FWD testing will continue to be collected on an annual or biennial schedule. Regional calibration factors, as provided by this study, will be added to the software for future design and project reviews. Finally, a calibration update will be performed when fatigue cracking on about half of the semi-rigid pavements exceeds 5%.

Note:

Two projects are pending completion of this project (see Sections 2.5.3.1 and 2.5.3.2).

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2.5.2 Contracted Projects

2.5.2.1 Axial Capacity of Piles Supported on Intermediate Geomaterials

Project Number:	8117-32
Start Date:	3/1/06
Completion Date:	7/31/08
Total Cost:	\$41,928
SPR Funds:	\$25,784
Contractor Cost Share:	\$16,144
FFY 2007 Funds Expended:	\$15,710
Unexpended Funds:	\$7,591
FFY 2007 MDT indirect Costs:	\$1,858
Status:	Contracted
Contractor:	Western Transportation Institute, Montana State University
URL:	http://www.mdt.mt.gov/research/projects/mat/axial.shtml

Objective:

The axial capacity, driving resistance, and long-term resistance of piles driven into intermediate geomaterials are not well established. There is little to no published guidelines for addressing the properties of these materials in terms of pile axial capacity.

Intermediate geomaterials are encountered throughout Montana and it is anticipated that a significant number of future bridge foundations will be founded in these materials, especially in the eastern portion of the state. Because the expense of conducting pile loading tests is cost prohibitive for most bridge projects, MDT geotechnical engineers and geologists could greatly benefit from improved empirical procedures for performing axial pile analyses, predicting driving resistances, predicting axial resistance, and estimating pile tip depth.

The primary objective of this study will be to develop empirically based guidelines for the analysis and design of piles driven into intermediate geomaterials. The guidelines will be developed by conducting back analyses using previously collected data from pile installation projects.

Results from this study will have the potential to improve the reliability and cost effectiveness of a significant number of future bridge foundations in the state of Montana.

Progress:

The literature review is complete, but will be updated prior to project completion. Data has been collected. Data analysis and synthesis is ongoing.

Reports:

At the project outset, the Technical Panel requested alternating semi-annual progress reports and semi-annual meetings between the Technical Panel and the researchers, with meeting notes prepared by the researchers. In FFY 2007, there were three meetings and one quarterly progress report. The Panel felt more meetings and less progress reports were necessary. Project information can be viewed at the above URL.

MDT Project Manager:

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Contractor Project Manager:

Bob Mokwa
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2.5.2.2 I-15 North Corridor - Canadian Truck Load Bridge and Roadway Analysis

Project Number:	8192
Start Date:	8/15/07
Completion Date:	7/31/08
Total Cost:	\$34,366
SPR Funds:	\$27,493
Contractor Cost Share:	\$6,873
FFY 2007 Funds Expended:	\$0
Unexpended Funds:	\$27,493
FFY 2007 MDT indirect Costs:	\$0
Status:	Contracted
Contractor:	Western Transportation Institute, Montana State University
URL:	http://www.mdt.mt.gov/research/projects/planning/btrains.shtml

Objective:

The purpose of this project is to investigate the infrastructure impacts of allowing Canadian B-trains operating at the weight limits used in Alberta, Canada to travel on Interstate Highway 15 between Great Falls and the Canadian Border. This weight is currently allowed by Federal law between Shelby and the Canadian Border. In an 8 axle configuration, the maximum allowable gross weight of a B-train in Alberta of 140,000 pounds (Alberta Government, 2007) is significantly higher than the allowable gross weight on a comparable 8 axle Montana A-train of 117,000 pounds. If Federal law is changed to allow Canadian B-trains to run further south than Shelby, it is expected that users and providers of transportation services would make adjustments in their operations to take advantage of this increased cargo capacity. Potential highway system impacts associated with these adjustments range from changes in the composition of the traffic stream along this corridor, to changes in the demands the new vehicle stream places on the highway infrastructure of the corridor. Investigation of these potential impacts is needed to respond to inquiries from shippers, businesses, and Alberta interests, and to help inform decisions on infrastructure issues relative to this topic. Ideally, the information developed in this project (and the processes followed) can be used as a model to assess any corridor that is identified for future analysis of Canadian B-train operation relative to potential infrastructure impacts on Montana's highway infrastructure.

Progress:

This project was initiated just prior to the end of FFY 2007.

2.5.3 Pending Projects

2.5.3.1 Implementation of the Mechanistic Empirical Pavement Design Guide for Designing Flexible Pavements in Montana

This project is pending completion of *Pavement Performance Prediction Models* (see Section 2.5.1.3). A Technical Panel will be set up and will meet early in FFY 2008.

Project Manager:

Sue Sillick
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2.5.3.2 Determination of Unbound Base and Subgrade Resilient Moduli for use in the Mechanistic-Empirical Pavement Design Guide

This project is pending completion of *Pavement Performance Prediction Models* (see Section 2.5.1.3). A Technical Panel will be set up and will meet early in FFY 2008.

Project Manager:

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2.6 PLANNING AND SAFETY RESEARCH PROJECTS

2.6.1 Completed Projects

2.6.1.1 A High Fidelity Driving Simulator as a Tool for Highway Design and Evaluation of Highway Infrastructure Upgrades

Project Number:	8117-33
Start Date:	4/1/06
Completion Date:	5/31/07
Total Cost:	\$48,000
SPR Funds:	\$26,202
Contractor Cost Share:	\$21,798
FFY 2007 Funds Expended:	\$10,510
Unexpended Funds:	\$0
Status:	Complete
Contractor:	Western Transportation Institute, Montana State University
URL:	http://www.mdt.mt.gov/research/projects/safety/high_fidelity.shtml

Objective:

High fidelity driving simulators provide an opportunity to simulate and test drivers' responses to improvements in infrastructure, information and warning messages, and other deployments. The planned deployments on U.S. 191 in the vicinity of Big Sky, Montana were an excellent opportunity for using a simulator for rapid prototyping. For many of the scheduled deployments of curve, ice, and excessive speed warnings, driving simulation would provide a tool to refine the plan for location, visibility, and message sets. Simulation capability to quickly and inexpensively evaluate these proposed deployments was determined by creating and testing a simulation.

Progress:

All work is complete

Reports:

The final report was completed, published, distributed, and can be viewed at the above URL.

Implementation:

The results of this study indicate variable speed limit signs may reduce the travel speeds along the corridor. Speed is only one variable that may help reduce the crash rate in this area. Additional ITS technologies and roadway geometries should be evaluated to determine their effectiveness as well.

MDT Project Manager:

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Contractor Project Manager:

Michael Kelly
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2.6.2 Contracted Projects

2.6.2.1 Effects of Defensive Vehicle Handling Training on Novice Driver Safety: A Case Study in Lewistown, Montana: Phase III Analysis of Safety Data

Project Number:	8183-003
Start Date:	5/1/06
Completion Date:	4/30/10
Total Cost:	\$170,000
SPR Funds:	\$85,000
Contractor Cost Share:	\$85,000
FFY 2007 Funds Expended:	\$26,106
Unexpended Funds:	\$36,271
FFY 2007 MDT Indirect Costs:	\$2,257
Status:	Contracted
Contractor:	Western Transportation Institute, Montana State University
URL:	http://www.mdt.mt.gov/research/projects/safety/defensive.shtml

Objective:

New teenaged drivers have the highest accident rates of any group of drivers. Research shows that drivers under the age of 19 have a crash rate that is four times that of the general driving population and the youngest drivers have a higher accident rate yet. The highest accident rate is experienced within 2 years of receiving the driving license. Obviously, the crash rate decreases with driving experience. Research is needed to determine how to safely equip novice drivers with the important elements of experience before they encounter a need for it in an actual driving situation.

The purpose of this research program is to conduct such a study. This project was divided into three phases. In the first two phases, accident records for young Montana drivers were analyzed and a defensive driving curriculum was designed to address the most common risks. Approximately 400 young drivers were recruited in central Montana to take part in the study. Half received a one day intervention of advanced defensive driving during the summer of 2005. This third phase involves the longitudinal collection and analysis of accident and violation data.

Progress:

The 2007 survey of young drivers were mailed to the project participants and the surveys were returned. The results are currently being compiled and analyzed. These results should be available in January 2008.

WTI worked with the Montana OPI to complete an additional analysis of the results of the 2006 survey reports of crashes. The training objectives of the defensive driving workshop were listed and each reported crash was categorized as to whether driver performance leading to the crash was a training objective of the workshops. It was found that young drivers who did not receive the training had approximately 2.5 times as many crashes as their trained counterparts when facing challenges that were primary objectives of the training. Where the workshops didn't address a specific challenge, there was little difference between the two groups of participants. A supplemental report summarizing these data is being prepared.

Reports:

One annual interim report was submitted. The 2007 annual interim report was due at the end of FFY 2007.

MDT Project Manager:

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Contractor Project Manager:

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2.6.2.2 Automated Cost Recovery

Project Number:	8186
Start Date:	11/1/06
Completion Date:	4/30/08
Total Cost:	\$106,993
SPR Funds:	\$53,943
Contractor Cost Share:	\$53,050
FFY 2007 Funds Expended:	\$19,176
Unexpended Funds:	\$34,767
FFY 2007 MDT Indirect Costs:	\$893
Status:	Contracted
Contractor:	Western Transportation Institute, Montana State University

URL: http://www.mdt.mt.gov/research/projects/planning/cost_recovery.shtml

Objective:

The purpose of this project is to identify technologies such as smart cards or other cost recovery methods that could be deployed in transit systems in Montana. This project will determine if there are technologies that could be feasibly initiated in transit systems in Montana to make the process of collecting fares and reporting information to various agencies more effective and efficient.

Progress

Automated Cost Recovery (ACR) systems in present use and those currently used in Montana are in review. The cost/benefit analysis is 60% complete and the implementation plan is in progress.

Reports

Four progress reports were received in FFY 2007 and can be viewed at the above URL along with other project information.

MDT Project Manager:

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Contractor Project Manager:

David Kack
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2.6.2.3 Developing a One-Stop Shop for Public/Specialized Transportation Information in Montana

Project Number:	8188
Start Date:	12/1/06
Completion Date:	3/31/08
Total Cost:	\$135,615
SPR Funds:	\$135,615
FFY 2007 Funds Expended:	\$84,215
Unexpended Funds:	\$51,400
FFY 2007 MDT Indirect Costs:	\$4,652
Status:	Contracted
Contractor:	PBS&J
URL:	http://www.mdt.mt.gov/research/projects/planning/one_stop.shtml

Objective:

The purpose of this project is to develop a “one-stop shop” for public and specialized transportation information in Montana. This project will develop an approach to provide a feasible, realistic implementation plan the Montana Department of Transportation (MDT) and its partners will be able to use in order to provide better and more consistent information to the public. The plan recognizes that, while research is a fundamental part of the process, the research has no value unless it can be translated into a results-oriented working document.

Progress

Focus groups were conducted to gather information regarding traveler information needs. Follow up with additional contacts occurred to supplement the focus group information. The implementation plan is currently being synthesized.

Reports:

Ten progress reports were received in FFY 2007 and can be viewed at the above URL along with other project information.

MDT Project Manager:

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Contractor Project Manager:

Peter Costello
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2.6.2.4 Highway Project Cost Estimating Best Practices

Project Number: 8189
Start Date: 3/1/07
Completion Date: 9/30/08
Total Cost: \$204,130
SPR Funds: \$204,130
FFY 2007 Funds Expended: \$112,601
Unexpended Funds: \$91,529
FFY 2007 MDT Indirect Costs: \$6,948
Status: Contracted
Contractor: Sierra Transportation Engineers
URL: http://www.mdt.mt.gov/research/projects/const/project_cost.shtml

Objective:

The overall objective of this project is to develop a comprehensive document to determine the best practice of efficient highway cost estimating for Montana.

Progress

The consultant team is currently reviewing all aspects of the Department's structure, operations, and current processes related to project cost activities. In addition, the team visited MDT to interview staff associated with project cost duties and management.

Reports:

Seven progress reports were received and can be viewed at the above URL along with other project information.

MDT Project Manager:

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Contractor Project Manager:

Sirous Alavi
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2.6.2.5 Logistics and Marketing Research in Support of Container on Flatcar Shuttle Train on BNSF Mainline to Port of either Seattle or Tacoma

Project Number: 8191
Start Date: 6/1/07
Completion Date: 4/30/08
Total Cost: \$92,036
SPR Funds: \$92,036
FFY 2007 Funds Expended: \$54,320
Unexpended Funds: \$35,996
FFY 2007 MDT Indirect Costs: \$5,886
Status: Contracted
Contractor: Prime Focus
URL: <http://www.mdt.mt.gov/research/projects/admin/flatcars.shtml>

Objective:

The current intermodal situation in Montana and the hardship resulting from the lack of these services represent a substantial challenge to the shippers and economic developers within the State. The Burlington Northern Santa Fe (BNSF) offers intermodal trailer service from Chicago to Billings for select private equipment owners but no outbound freight from Billings is loaded to the train. Competitive rates and services are needed for shippers and receivers in Montana to be competitive in domestic and international markets. Value added agriculture commodities rely on containerized transportation systems to compete in world markets and the absence of these services in Montana represents a significant barrier to their competitive position.

Progress

The literature review is complete. The electronic survey to Canadian and Montana shippers was issued, and responses were received and are currently under review.

Reports:

Four progress reports were received in FFY 2007 and can be viewed at the above URL along with other project information.

MDT Project Manager:

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Contractor Project Manager:

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2.6.3 Pending Projects

2.6.3.1 Computerized 3-Dimensional Highway Design and Modeling

The following research problem statement was submitted. The Technical Panel met numerous times in FFY 2007. The Department with support from the technical panel decided to move this effort to an internal process with the lead taken up by the Survey Issues Committee. Research provided a survey of practice from other state DOT's and Canadian Provinces, including: design specifications, guidelines, mapping standards, and design methodology to assist the committee in this effort.

Problem Statement:

MDT construction contracts are being awarded to contractors who are either currently using machine control or are planning to use machine control in the future. Machine control is an emerging technology that allows a contractor to build a project using very little or no conventional construction staking. Machine control technology involves the use of GPS equipment connected to construction machinery that guides the operator during construction activities. The contractor uses the approved plans to create a 3-D model of the design either in-house or by using a consultant. The 3-D model is then loaded into computers on the machinery and combined with GPS, guides the equipment in the process of constructing the project. The problem is that once the 3-D model is generated, the approved plans, requiring a signature of the P.E. that is responsible and liable for the design, can be set aside and may have little influence on the construction. If there is no quality control or oversight of the 3-D modeling created and used by contractors, MDT could be exposed to considerable economic risk by any errors or omissions introduced to these 3-D models.

Research Proposed:

MDT has been creating 3-D models for years when we collect topographic data of the existing ground, input that data into GeoPak, and generate a digital terrain model (DTM) or 3-D model. A 3-D model of a project design is much more complicated to create and requires a high level of skill and ability. It may also require some specialized software in addition to MicroStation/GeoPak. The research proposed should focus on the use of and quality control of 3-D modeling done by the contractor and/or creation of 3-D models by MDT.

Project Manager:

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2.7 TRAFFIC RESEARCH PROJECTS

2.7.1 Pending Projects

2.7.1.1 Design of a Vertical Shape Portable Concrete Barrier

The following research problem statement was submitted. The Technical Panel has not yet met to determine if a research need exists, and, if so, develop a research plan.

Problem Statement:

Currently, all of the non-proprietary temporary concrete barrier systems in use on the national highway system are comprised of safety shape barrier segments made up of one or more sloped faces. These segments are connected by simple connections that allow the barriers to be easily installed or moved in work zones and other temporary barrier applications. Research has shown the sloped face of safety shape barriers causes increased vehicle instability and rollover, especially with regard to small cars. These studies have shown 8.5 percent of safety shape barrier accidents result in rollover, and that safety shape median barriers pose over twice the rollover rate of other median barriers. The increased rollover potential with these barrier shapes becomes critical because rollover accidents double the risk of incapacitating and fatal injuries.

Vertical shape concrete barriers have been shown to provide the largest reduction in vehicle rollover when compared with safety shape barriers through both computer simulation and full-scale crash testing. However, the use of vertical shapes has not been implemented due to concerns that vertical shapes might increase the lateral loads on impacting vehicles. Review of crash test data has demonstrated that this concern is not valid. Comparison of data from safety shape and vertical shape barrier testing found that vertical shape barriers only increase lateral vehicle accelerations by 5 percent. Vertical shape barriers would be easier to transport and store, thus increasing the functionality of the barrier. In addition, the use of a vertical shape could potentially decrease both the overall height and width of the barrier. Barrier reinforcement could be made simpler and more consistent throughout the barrier section due to its rectangular shape. Pre-cast vertical barrier segments may also be easier to form than the current sloped shapes. Because the new vertical shape barrier would start from a clean sheet of paper, the length of barrier sections and the design of the connection between barriers could be optimized to improve both the functionality and safety performance of the barrier system. Design of the new barrier would also include consideration for tie-down options to constrain barrier motion in critical areas such as barriers placed on a bridge deck edge. Therefore, it is believed that a new vertical shape temporary concrete barrier should be developed that would reduce the potential for vehicle

rollover while improving upon many of the shortcomings in current safety shape barrier designs.

Research Proposed:

The development process of the new vertical shape temporary barrier would include computer simulation modeling of barrier geometries, joint designs, and tie-down options, component testing of the various barrier design elements, and full-scale testing of the free-standing and tie-down barrier designs as well as transitioning methods according to Test Level 3 (TL-3) of NCHRP Report No. 350.

MDT Project Manager:

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3 EXPERIMENTAL PROJECTS

3.1 OVERVIEW

The incorporation of experimental features into construction and maintenance projects allows for a vital field evaluation of new materials and methods. This evaluation, if performed well and scientifically based, allows MDT to determine the implementation value of these new materials and methods.

3.1.1 Work Plan

Prior to construction of an experimental feature, the Experimental Projects Manager (EPM) writes and submits a formal work plan to FHWA for their approval. This work plan should include the following information:

- Location of project,
- Construction project number,
- Title (type) of project,
- Principal investigator,
- Statement of objectives,
- Experimental design,
- Estimated quantities and costs,
- Evaluation schedule, and
- Reporting requirements.

This work plan is important as it formalizes the project with FHWA, which yields two additional benefits:

- FHWA will participate in the original construction and repair, if the project should fail prematurely, at 100% and
- Proprietary features may be specified.

3.1.2 Construction Report

Following the construction of an experimental feature, the EPM is required to submit a construction report for statewide distribution through the Research Programs. This report should be written within thirty days of completed construction of the project and should include:

- Location of project,
- Construction project number,
- Title (type) of project,
- Principal investigator,

- Statement of objectives,
- Date construction of experimental feature was completed,
- Summary of materials and methods,
- Quantity and cost of experimental feature,
- Construction details, and
- Construction problems and a statement of how these problems might have been alleviated.

3.1.3 Progress and Final Reports

Progress and final reports are required by the FHWA throughout the formal evaluation period as stated in the work plan and should be completed within 30 days of the performance evaluation. Reports consist of a performance summary of the experimental feature to date. The final performance summary should contain information on the experimental feature as specified in the work plan, including implementation recommendations. Implementation recommendations should also be presented to MDT management. This report is due by the end of the final evaluation year.

3.2 COMPLETED PROJECTS

3.2.1 Detectable Warning Devices for the Visually Impaired Evaluation

Project Name: Great Falls Truncated Domes
Project Number: STPU 5201(11)
FHWA Number: MT 00-05
Construction Date: August 2003
Completion Date: September 2007
Status: Complete
Contractor: Various
URL: http://www.mdt.mt.gov/research/projects/6th_street.shtml

Objective:

The objective of this project was to test the construction application, durability, and maintenance requirements of several truncated dome products as a preferred detectable warning device (DWD) at curb ramps for use by the visually and mobility impaired.

Progress:

Numerous products were tested with none meeting performance standards.

Reports:

Final and annual reports can be viewed at the above URL.

MDT Project Manager:

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3.2.2 Pavement Markers on MacDonald Pass Evaluation

Project Name: MacDonald Pass – Lewis & Clark County
Project Number: Maintenance Project No. 307945
FHWA Number: MT 00-12
Construction Date: September 2006
Completion Date: June 2007
Status: Complete
Contractor: Arrow Striping and Manufacturing, Inc.
URL: http://www.mdt.mt.gov/research/projects/macpass_markings.shtml

Objective:

The objective of this project was to compare current practice using epoxy type markings with various urethane modified type markings for long-term durability and retro-reflectivity. Various types of grinds (depth of cut) were employed to determine if this variable affected performance of the products.

Progress:

This project is complete.

Reports:

The final report is pending. Project information can be viewed at the above URL.

MDT Project Manager:

Craig Abernathy
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3.2.3 Radar Speed Display Trailer-Mounted Device for Speed Reduction in Construction Work Zones Evaluation

Project Name: Bear Canyon
Project Number: IM 90-6(90)304, UPN 3612
FHWA Number: MT 00-11
Start Date: May 2006
Completion Date: November 2006
Status: Complete
Contractor: Not Applicable – Internal Research
URL: http://www.mdt.mt.gov/research/projects/bear_canyon.shtml

Objective:

This project was an experimental trial of trailer-mounted automated radar speed displays for use in potential speed reduction in construction work zones.

Progress:

The project is complete. The trailer-mounted speed display had little effect on maintaining the posted speed limit or reducing overall average speed through this type of work zone.

Reports:

Available information can be viewed at the above URL.

MDT Project Manager:

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3.2.4 Treated Base Preparations, (Emulsified Asphalt Treated Aggregate) Evaluation

Project Name: Sportmans Campground – East
Project Number: STPP 46-5(2)51
FHWA Number: MT 00-14
Construction Date: October 2006
Completion Date: May 2007
Status: Complete
Contractor: Ascorp Inc.- DBA Debco Construction
URL: <http://www.mdt.mt.gov/research/projects/sportsman.shtml>

Objective:

The Sportsman's Campground project was a reconstruct that includes grading, gravel, plant mix surfacing, seal/cover, and two bridges. This project was an experimental pug-milling trial using various depths of Cationic Slow Set Emulsion (CSS1) at varying residual asphalt contents (RAC) to determine the effectiveness as a wearing course through the winter months until construction can be completed in the spring. This procedure was originally suggested as a dust palliative, but it was determined it may be effective in allowing winter traffic a more stable driving base than the use of straight gravel.

Progress:

The project is completed. Research has been asked to monitor the new pavement to determine if the EATA application plays a part in the overall performance of the asphalt cement pavement (see Section 3.4.5).

Reports:

Available information can be viewed at the above URL.

MDT Project Manager:

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3.3 ACTIVE PROJECTS

3.3.1 100 mm Thin Composite Whitetopping

Project Name: Glendive Whitetopping
Project Number: STPP 20-1(8)0 P-20, Highway 16
FHWA Number: MT 00-04
Construction Date: May 2001
Completion Date: September 2011
Status: Active
Contractor: Century Contracting
URL: http://www.mdt.mt.gov/research/projects/gld_whitetopping.shtml

Objective:

The objective of the project is to test the performance of whitetopping as a pavement preservation method. The existing asphalt pavement was milled and a 100mm (approximately 4 inches) Portland Cement Concrete Pavement (PCCP) overlay was placed to create a composite pavement. The goal is to extend the pavement service life.

Progress:

The project has been in place for six years with good performance to date. MDT Research will continue with formal analysis through the year 2011.

Reports:

One construction report and six annual reports can be viewed at the above URL.

MDT Project Manager:

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3.3.2 130 mm Thin Composite Whitetopping

Project Name: Kalispell Whitetopping
Project Number: STPP 1-2(93)121
FHWA Number: MT 00-02
Construction Date: August 2000
Completion Date: September 2010
Status: Active
Contractor: Riverside Contracting
URL: http://www.mdt.mt.gov/research/projects/kal_whitetopping.shtml

Objective:

The objective of the project is to test the performance of whitetopping as a pavement preservation method. The existing asphalt pavement was milled and a 130mm (approximately 5 inches) Portland Cement Concrete Pavement (PCCP) overlay was placed to create a composite pavement. The goal is to extend the pavement service life.

Progress:

The project has been in place for seven years with excellent performance to date. MDT Research will continue with formal analysis to the year 2010.

Reports:

One construction report and seven annual reports can be viewed at the above URL.

MDT Project Manager:

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3.3.3 Automated Fixed Anti-Icing Device for Use on Bridge Decks Evaluation

Project Name: West Laurel Interchange
Project Number: IM-STPHS 90-8(152)433
FHWA Number: MT 00-07
Construction Date: November 2007
Completion Date: September 2011
Status: Active
Contractor: Boschung America LLC
URL: http://www.mdt.mt.gov/research/projects/blg_deicer.shtml

Objective:

This project is an experimental trial of an automated anti-icing device for use on a Billings district area bridge for the purposes of decreasing winter accidents. The chosen device is the Boschung 'Fixed Automated Spray Technology or 'FAST'.

Progress:

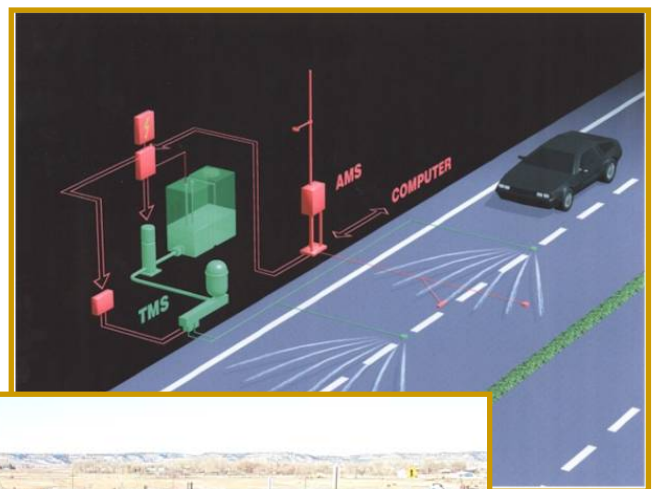
Installation of the FAST anti-icing device was completed in December 2006. Systems check and testing was completed by January 2007. This system will be fully functional for the 2007-08 winter season.

Reports:

The construction report and other available information can be viewed at the above URL.

MDT Project Manager:

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3.3.4 Cold In-Place Recycled Asphalt

Project Name: Fairfield North & South
Project Number: STPP 3-1(15)18
FHWA Number: N/A - Informal
Construction Date: September 2001
Completion Date: September 2011
Status: Active
Contractor: Riverside Contracting
URL: <http://www.mdt.mt.gov/research/projects/fairfield.shtml>

Objective:

This experimental rehabilitation project consists of cold milling approximately 75-90 mm of asphalt cement, replacing it with cold in-place recycled plant mix surfacing (90 mm), and placing a seal & cover.

Progress:

The project is in its sixth year since construction and is rated as performing well. MDT Research will continue to monitor performance informally for the life of the project.

Reports:

Five annual reports can be viewed at the above URL.

MDT Project Manager:

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3.3.5 Cold In-Place Recycled Asphalt using Koch's CIR-Engineered Emulsion

Project Name: Red Lodge North
Project Number: STPP 28-2(22)70
FHWA Number: MT 00-03
Construction Date: July 2001
Completion Date: September 2011
Status: Active
Contractor: Riverside Contracting
URL: <http://www.mdt.mt.gov/research/projects/redlodge.shtml>

Objective:

This is an experimental rehabilitation project consisting of cold milling approximately 75 mm of asphalt cement, replacing it with cold in-place recycled (CIPR) using Koch's CIR-EE (Cold In-Place Engineered Emulsion), plant mix surfacing, and placing a seal & cover. This project consists of two control sites and four test sections.

Progress:

The project is rated as performing well. All test sections to date have exhibited acceptable performance in regard to rutting and transverse cracking. MDT Research will continue to report on the performance of the project informally for the life of the pavement.

Reports:

One construction report and six annual reports can be viewed at the above URL.

MDT Project Manager:

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3.3.6 Crack Sealing Milled Asphalt Pavement prior to Overlay Evaluation

Project Name: Dutton N & S
Project Number: IM 15-6(35)309
FHWA Number: MT 00-08
Construction Date: June 2005
Completion Date: September 2010
Status: Active
Contractor: Schellinger Construction
URL: <http://www.mdt.mt.gov/research/projects/dutton.shtml>

Objective:

The objective of this project is to determine if crack sealing milled pavement prior to overlay will deter the migration of transverse cracking, or have an effect on pavement performance, when compared to an adjacent milled pavement that receives no crack sealing.

Progress:

To date, there is no evidence of cracking on either the test or control sections.

Reports:

Two annual reports are available at the above URL.

MDT Project Manager:

Craig Abernathy
406.444.6269
cabernathy@mt.gov



3.3.7 Detectable Warning Devices Evaluation

Project Name:	Various
Project Number:	Various
FHWA Number:	N/A - Informal
Construction Date:	Various
Completion Date:	Ongoing
Status:	Active
Contractor:	Various
URL:	N/A

Objective:

The purpose of this project is to review and report performance on installations of detectable warning devices (DWD's) in various locations in the State.

Progress:

This is an ongoing effort to determine the most effective DWD for use by the Department in ADA projects.

Reports:

As requested.

MDT Project Manager:

Craig Abernathy
406.444.6269
cabernathy@mt.gov



3.3.8 Edge-Line Pavement Markings on Rumble Stripes Evaluation

Project Name:	Various
Project Number:	Various
FHWA Number:	N/A - Informal
Construction Date:	Various
Completion Date:	Ongoing
Status:	Active
Contractor:	Various
URL:	N/A

Objective:

The purpose of this project is to review and report performance on the durability of applying edge-line pavement markings in rumble stripes.

Progress:

The first project inspection at the Great Falls interstate site occurred in September 2007. Additional sites will be inspected in the spring of 2008.

Reports:

As requested.

MDT Project Manager:

Craig Abernathy
406.444.6269
cabernathy@mt.gov



3.3.9 GeoRidge Erosion Control Permeable Ditch Berm Evaluation

Project Name:	Epsie - East & West
Project Number:	NH 37-3(11)85
FHWA Number:	N/A - Informal
Construction Date:	April 2007
Completion Date:	September 2009
Status:	Active
Contractor:	Wickens Construction
URL:	Pending

Objective:

The objective is to deploy and evaluate the effectiveness of the GeoRidge device, a permeable ditch berm designed for erosion and sediment control, as compared to conventional waddles. GeoRidge is constructed as a durable UV stabilized HDPE and manufactured using a fully automated process to trap sediment.

Progress:

The first project inspection occurred in July 2007.

Reports:

The first annual inspection report is pending.

MDT Project Manager:

Craig Abernathy
406.444.6269
cabernathy@mt.gov



3.3.10 High-Density Polyethylene Culverts in Mainline Applications Evaluation

Project Name: Angela N&S
Project Number: STPP 18-1(9)18
FHWA Number: MT 00-09
Construction Date: May 2007
Completion Date: September 2012
Status: Active
Contractor: MK Weeding Construction Inc.
URL: http://www.mdt.mt.gov/research/projects/angela_north.shtml

Objective:

This project is an experimental trial of three high density polyethylene (HDPE) culverts sizes (750 mm, 900 mm, and 1200 mm) on a primary mainline application. The product chosen is the ADS N-12WT IB corrugated watertight and soil tight, smooth interior polyethylene pipe.

Progress:

Installation of HDPE is completed. The construction report was written. Annual evaluations will be conducted beginning in spring 2008.

Reports:

The construction report was written and, along with other project information, can be viewed at the above URL.

MDT Project Manager:

Craig Abernathy
406.444.6269
cabernathy@mt.gov



3.3.11 High-Performance Concrete Bridge Deck Evaluation

Project Name: South Helena Interchange
Project Number: NH-STPU-CM-MT-STPE 15-4(108)191
FHWA Number: MT 00-16
Construction Date: September 2007
Completion Date: September 2012
Status: Active
Contractor: Tamietti Construction Co.
URL: Pending

Objective:

The primary objective of this project is to demonstrate and document the constructability and advantages of high-performance concrete (HPC) in bridge decks. Premature deterioration of concrete bridges and new advances in concrete technology make high performance concrete (HPC) an attractive option for new bridges. Recent MDT sponsored research resulted in HPC specifications for Montana (see Section 2.3.1.1). This experimental project will serve to test and qualify the use of the new HPC specifications in Montana.

Progress:

The project was constructed at the end of FFY 2007. Placement of the deck proceeded as planned. The bridge is open to traffic and performing well.

Reports:

The construction report is pending.

MDT Project Manager:

Craig Abernathy
406-444-6269
cabernathy@mt.gov



3.3.12 Recycled Plastic Mat as Weed Prevention and Erosion Control around Guardrail Posts Evaluation

Project Name: Great Falls N & S
Project Number: IM 15-5(101)270, UPN 4041
FHWA Number: MT 00-10
Construction Date: September 2007
Completion Date: September 2012
Status: Active
Contractor: United Materials
URL: http://www.mdt.mt.gov/research/projects/gtf_rubber.shtml

Objective:

The Department currently paves areas around guardrail with asphalt cement (AC) for erosion and weed control. The objective of this project is to test two products made from recycled rubber and plastic mats to determine if this could be a cost effective alternative to paving with AC.

Progress:

Construction is complete and guardrail mats are under review.

Reports:

Available information can be viewed at the above URL.

MDT Project Manager:

Craig Abernathy
406.444.6269
cabernathy@mt.gov



3.3.13 Tower-Mounted Wind Turbine for the Generation of Supplemental Power for the Anaconda Interchange Rest Area Evaluation

Project Name:	Anaconda Interchange Rest Area
Project Number:	IM 90-4(48)208 CN 4296
FHWA Number:	MT 00-15
Construction Date:	Spring 2008
Completion Date:	September 2013
Status:	Active
Contractor:	Robert Peccia & Associates
URL:	Pending

Objective:

The purpose of this project is to determine the effectiveness in reducing the grid-line power usage through the installation of a tower-mounted utility grid interconnected wind turbine to provide supplemental power to an interstate rest area. Equipment to be deployed consists of a 30 meter (98 ft) in height, free-standing lattice tower supporting a 3 blade, 6.7 meter (22 ft) rotor diameter; Bergey Windpower model 10 kW wind turbine.

Progress:

Installation of the wind turbine was delayed until spring of 2008.

Reports:

Pending

MDT Project Manager:

Craig Abernathy
406.444.6269
cabernathy@mt.gov



3.4 PENDING PROJECTS

3.4.1 Chip Seal as an Interlayer in an Asphalt Cement Pavement to Retard Reflective Cracking Evaluation

Objective:

The purpose of this project is to determine if a conventional chip seal applied between two lifts of asphalt cement (AC) can reduce the occurrence of reflective cracking in the pavement.

Progress:

Construction is planned for summer of 2008.

MDT Project Manager:

Craig Abernathy
406.444.6269
cabernathy@mt.gov

3.4.2 Deer Reflectors Evaluation

Objective:

The purpose of this project is to perform an analysis of the effectiveness of deer reflectors to mitigate animal-vehicle collisions.

Progress:

This project is tentatively scheduled for installation in summer of 2008.

MDT Project Manager:

Craig Abernathy
406.444.6269
cabernathy@mt.gov

3.4.3 Fabrics to Mitigate Transverse Cracking Evaluation

Objective:

The purpose of this project is to evaluate up to four types of paving fabric with regards to mitigating transverse cracking.

Progress:

Construction is planned for summer of 2008.

MDT Project Manager:

Craig Abernathy
406.444.6269
cabernathy@mt.gov

3.4.4 Highways for Life Program: Rehabilitation of Ten Failed Culverts with Two New Construction Methods to Minimize Traffic Delay

Objective:

This project is located on US 12 in Powell and Lewis and Clark Counties over McDonald Pass. The purpose of this project is to provide erosion control and replace or upgrade guardrail along a high volume 4-lane National Highway System route (US 12). Erosion control involves removing material in the 10-24 inch pipes and lining existing culverts, which are deteriorated to the point of requiring replacement, using one of two new construction methods for the State of Montana.

Progress:

Construction is planned for summer of 2008.

MDT Project Manager:

Craig Abernathy
406.444.6269
cabernathy@mt.gov

3.4.5 Pavement Performance with Prior Emulsified Asphalt Treated Aggregate Base Treatment Evaluation

Objective:

The purpose of this project is to evaluate the asphalt pavement performance of paved emulsified asphalt treated aggregate (EATA) sections installed on the Sportsman's Campground East project (see section 3.2.3).

Progress:

Annual performance analysis will begin in fall 2008.

MDT Project Manager:

Craig Abernathy
406.444.6269
cabernathy@mt.gov

3.4.6 Plant Mix Surface with In-Laid Thermoplastic Markings prior to Seal Coat Application Evaluation

Objective:

The intent of this experiment is to identify a less costly method of preparing plant mix surfaces having hot in-laid thermoplastic pavement markings for use prior to seal coat application. Five projects will be evaluated.

Progress:

Construction is planned for summer 2008.

MDT Project Manager:

Craig Abernathy
406.444.6269
cabernathy@mt.gov

3.5 CANCELLED PROJECTS

3.5.1 Aggregate Base Preparations Evaluation

Project Name: Angela N&S
Project Number: STPP 18-1(9)18
FHWA Number: MT 00-13
Start Date: Spring 2007
Completion Date: September 2012
Status: Cancelled
Contractor: MK Weeding Construction Inc.
URL: http://www.mdt.mt.gov/research/projects/angela_north.shtml

Objective:

Creating premium road base out of troublesome aggregates or soils is part of a successful formula in building superior performing pavements. In this effort, the Montana Department of Transportation was planning to initiate an experimental trial of various aggregate base preparations in an effort to determine effectiveness of these treatments for potential use in future road construction projects.

Progress:

Project has been cancelled due to financial constraints.

Reports:

Available information can be viewed at the above URL.

MDT Project Manager:

Craig Abernathy
406.444.6269
cabernathy@mt.gov



4 POOLED-FUND STUDIES

MDT contributed to the following pooled-fund studies in FFY 2007. Click on the project links to view project information.

Table 2: Pooled-fund contributions for FFY 2007

NUMBER	NAME	FUNDING LEVEL
TPF-5(064)	Western Alliance for Quality Transportation Construction (WAQTC) http://www.pooledfund.org/projectdetails.asp?id=274&status=4	\$10,000
TPF-5(068)	Long-term Maintenance of Load Resistance Factor Design http://www.pooledfund.org/projectdetails.asp?id=286&status=4	\$20,000
TPF-5(069)	Transportation Research Board Support of Core Services http://www.pooledfund.org/projectdetails.asp?id=300&status=6	\$99,900
TPF-5(099)	Evaluation of Low Cost Safety Improvements http://www.pooledfund.org/projectdetails.asp?id=332&status=4	\$30,000
TPF-5(112)	Midwest States Pooled Fund Pavement Preservation Partnership http://www.pooledfund.org/projectdetails.asp?id=343&status=4	\$5,000
TPF-5(122)	Dynamic Passive Pressure on Abutments and Pile Caps http://www.pooledfund.org/projectdetails.asp?id=354&status=4	\$10,000
TPF-5(135)	Tire/Pavement Noise Research Consortium http://www.pooledfund.org/projectdetails.asp?id=364&status=4	\$10,000
TPF-5(150)	Extending the Season for Concrete Construction and Repair , Phase III http://www.pooledfund.org/projectdetails.asp?id=377&status=4	\$10,000
TPF-5(151)	Subsurface Drainage for Landslide and Slope Stabilization http://www.pooledfund.org/projectdetails.asp?id=378&status=4	\$5,000
TPF-5(161)	Transportation and emergency Preparedness Professional Capacity Building http://www.pooledfund.org/projectdetails.asp?id=385&status=4	\$10,000
	TOTAL	\$209,900

5 SUMMARY

5.1 GENERAL

MDT's mission is to serve the public by providing a transportation system and services that emphasize quality, safety, cost effectiveness, economic vitality, and sensitivity to the environment. MDT's Research Programs impacts each and every part of MDT's mission.

Research projects completed in FFY 2007 yielded results that when fully implemented will improve:

- Efficiency and effectiveness of MDT operations and technology transfer, including improving training of and encouraging young individuals to enter the transportation construction work force;
- Economic vitality;
- Sensitivity to the environment, including decreasing vehicle-wildlife collisions, improving habitat connectivity, improving design for safety and fish passage, and improving revegetation of roadsides;
- Safety, by decreasing roadside hazards, decreasing young driver accidents, through training and technology transfer; and
- Quality of what we do and how we do it, including bridge design and inspection, pavement design and preservation, use of the most efficient materials and technology, and materials testing and acceptance.

5.2 FISCAL

Research Programs expenditures occurred through research projects, pooled-fund studies, and NCHRP support (see Figure 5). Figure 6 shows these expenditures categorized by subject. The expenditures for the administration subject area are further classified by internal administration (overhead), NCHRP support, pooled-fund studies, and contracted research projects (Figure 7). Figure 8 shows internal administrative expenditures as compared to all other expenditures. MDT, as of July 2007, is required to charge indirect costs. These costs are revised each state fiscal year. From July 2007 to June 2008, the indirect cost rate charged to each expenditure is 12.25%. Figure 9 shows these indirect costs as compared to project expenditures for FFY 2007. For FFY 2007, direct project costs are 97% of total expenditures and indirect costs are 3% of total expenditures. The actual indirect cost rate is lower than 12.25% as indirect costs were applied only the last quarter of FFY 2007. Finally, Figure 10 shows total funding for all active research projects by funding source.

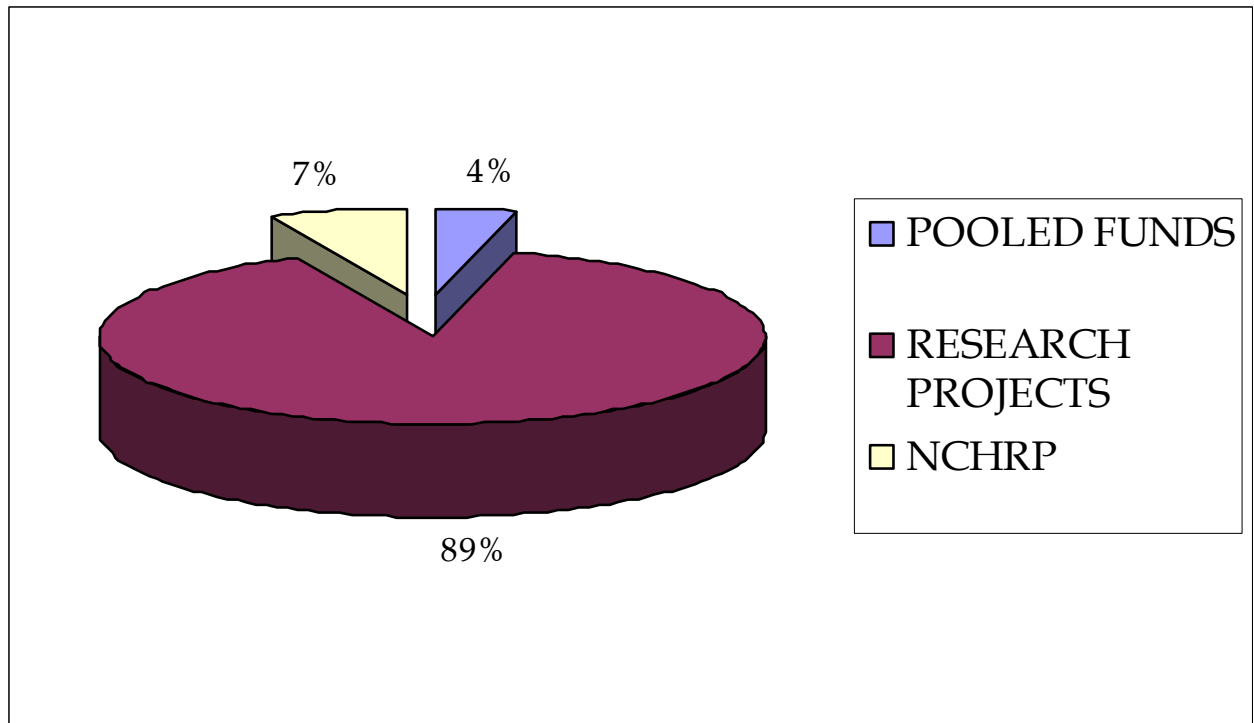


Figure 5: Research Program expenditures for FFY 2007 by project type.

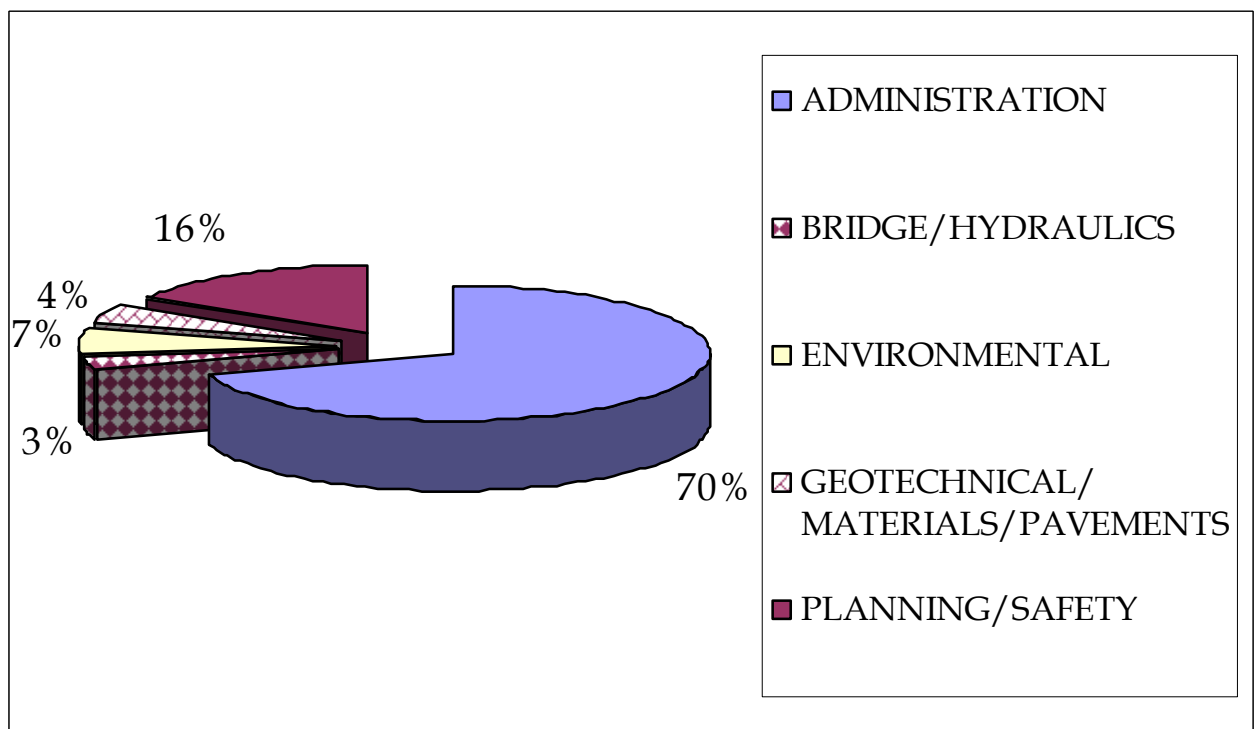


Figure 6: Research Program expenditures for FFY 2007 by subject.

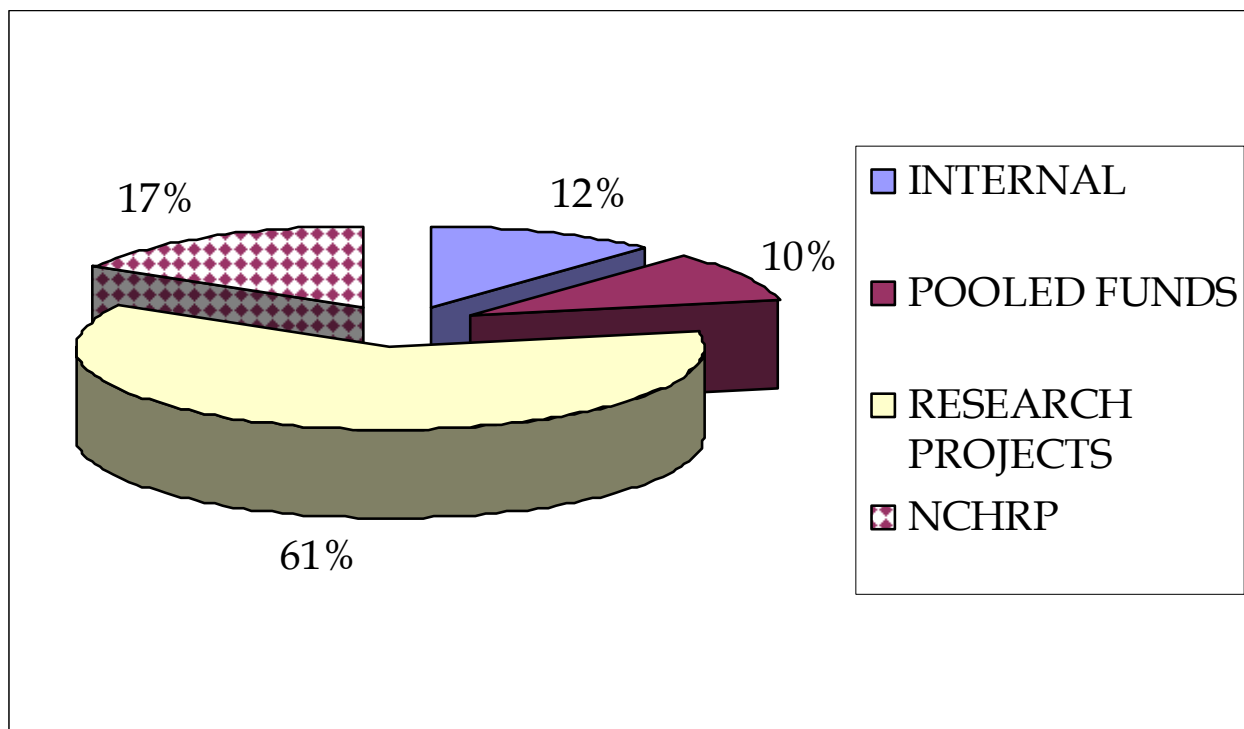


Figure 7: Administration expenditures for FFY 2007 by project type.

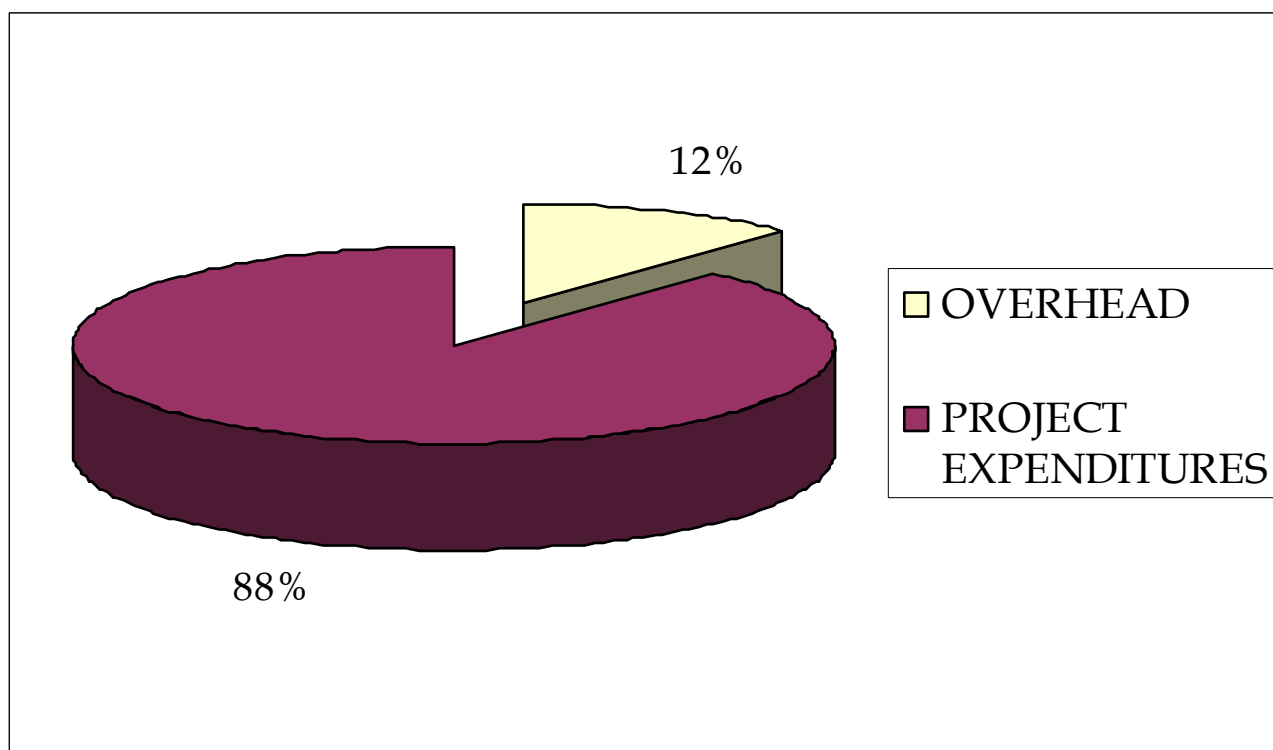


Figure 8: Overhead expenditures for FFY 2007 as compared to all other expenditures.

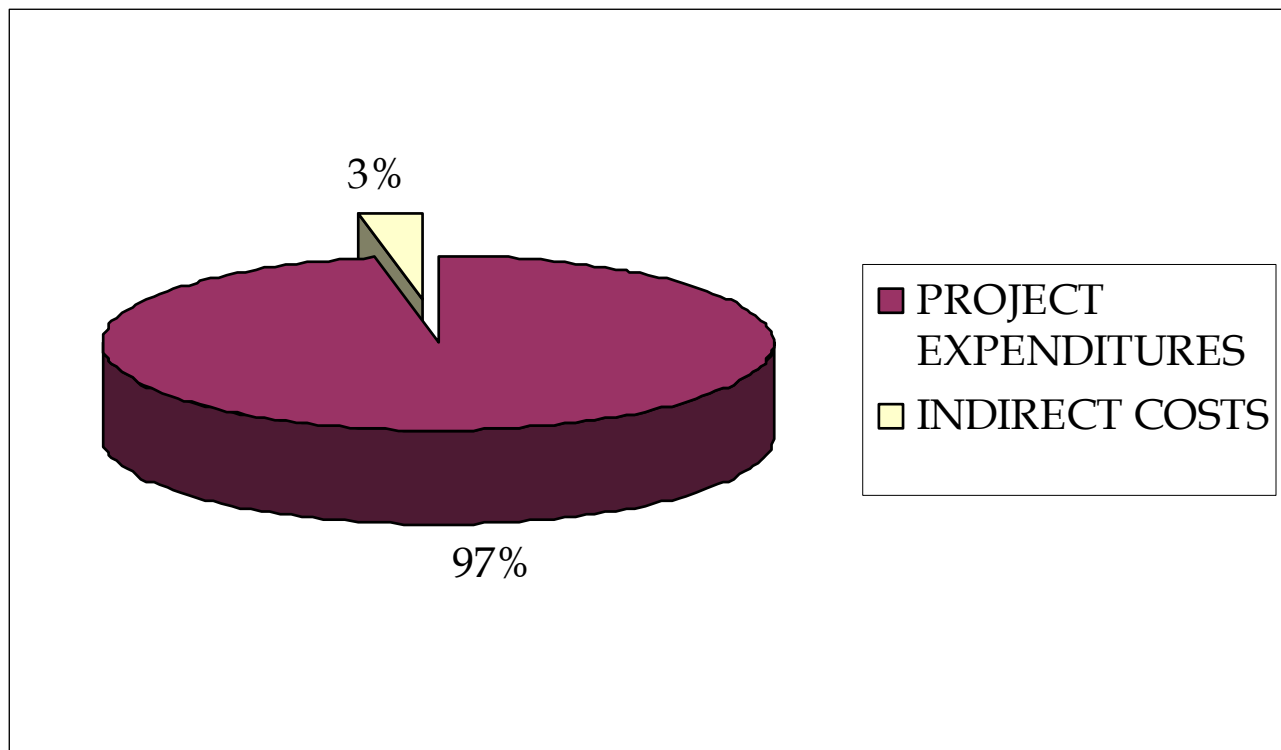


Figure 9: MDT indirect costs as compared to project expenditures for FFY 2007

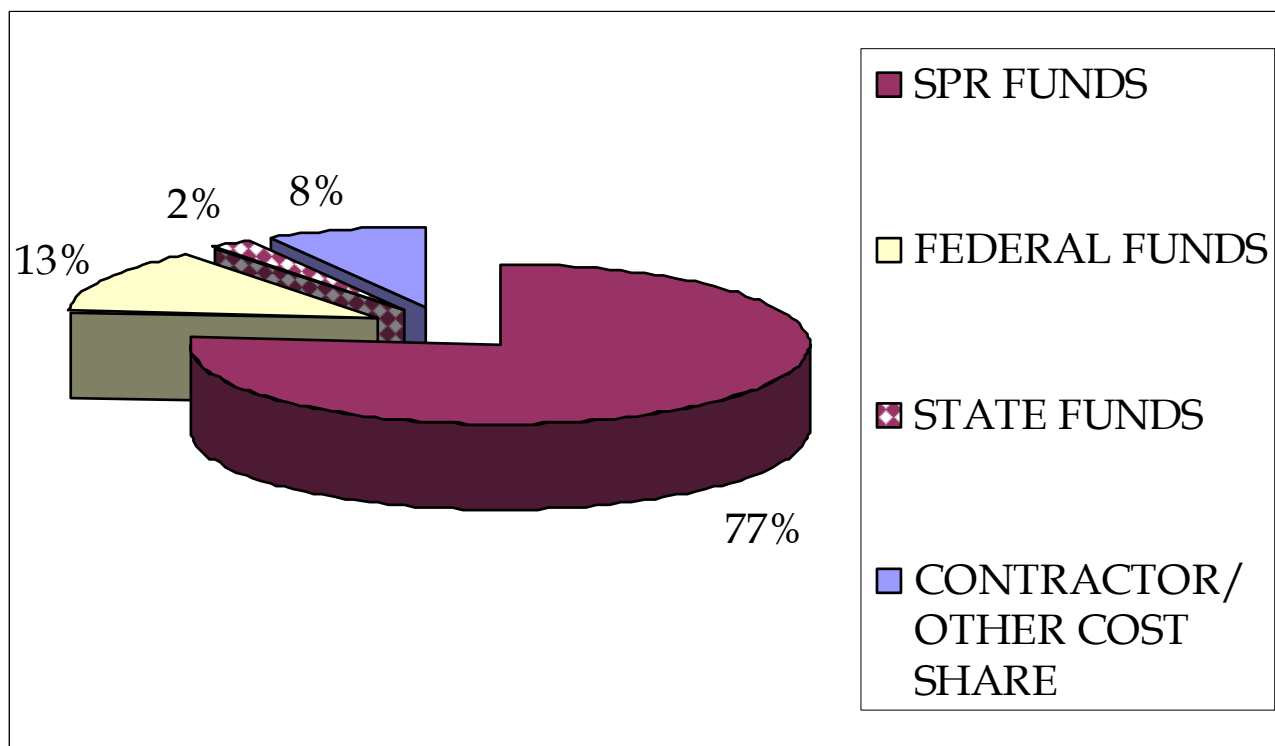


Figure 10: Total funding for all projects active in FFY 2007 by funding source.

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